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Life Tests on V-Belts

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With the increasing popularity of V-belt drives comes the necessity for exact information as to their correct method of application. A series of experiments, conducted exclusively for *American Machinist* and *Product Engineering*, defines the influence of load and pulley diameter on this type of drive

BELT operation, as almost any other engineering problem, is largely a question of economics in investment and economies in labor. We naturally wish to install the cheapest and simplest drive which will do the work required and which will last the longest possible time with a minimum amount of labor and expense. The upkeep expense of a belt operating between fixed centers is largely a matter of take-up. Everything else being equal, a belt which stretches but little should perhaps be selected in the first place. But belt stretch is influenced also by the load the belt has to carry and perhaps by the speed of the drive. F. W. Taylor, in the last decade of the nineteenth century, created a sensation by proving that it might pay to use belts twice as heavy and twice as expensive as those then in use because, by the reduction of load per square inch of section, the time between take-ups—and of course the time between renewals—was increased so much that after six or seven years the doubled initial investment was more than repaid.

Load, however, is not put on belt material merely by straight pull. It is also, and perhaps more seriously, introduced by the flexing of the belt over pulleys. By this flexing, the outside fibers of the belt are put under a tension which, for materials having a constant modulus of elasticity, is inversely proportional to the pulley diameter. Since this stress is not uniformly distributed over the section but in fact changes to compression in the inside fibers, it leads to an internal readjustment of the belt material with consequent internal wear.

Taylor's tests with leather belts in actual power transmission indicated that a reduction of load increased belt life in a ratio far greater than that of the first power of the load. Belts which were lasting only 5 to 6 years under common commercial loads gave indication of lasting 20 to 30 years when these loads were cut in half. The longer life had to remain a mere estimate since the tests lasted only nine years. The only thing one could say was that belts under favorable conditions had been known to last as much as 30 years.

With respect to the influence of pulley diameters, prevalent opinions were based on even more qualitative observations. It was known merely that main drive belts on large pulleys would last for years under loads which would have ruined them quite rapidly on small pulleys. More accurate data have of late been published by the Goodyear Tire & Rubber Company in the "Handbook of Belting," but these cover flat rubber belts only.

The question of the influence of load and pulley diameter on belt life has become particularly acute with the rise of V-belts. V-belts present in many ways an extremely desirable form of power transmission. They are smooth and silent. They can run over very short centers. In multiple arrangement, they give warning and reserve against breakage. They are extremely foolproof and require hardly any attention. The reason for this is that they depend for tractive power on a mechanical wedge action, which remains almost unimpaired through the years. Tractive power, produced by sur-

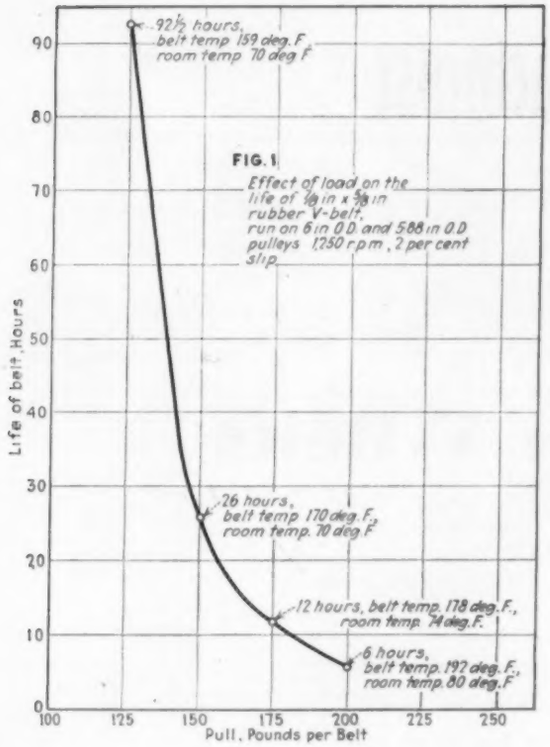

92½ hours, belt temp 159 deg. F., room temp 70 deg. F.
26 hours, belt temp 170 deg. F., room temp. 70 deg. F.
12 hours, belt temp. 178 deg. F., room temp. 74 deg. F.
6 hours, belt temp. 192 deg. F., room temp. 80 deg. F.
Life of belt, Hours
Pull, Pounds per Belt

FIG. 1 Effect of load on the life of ½ in x ⅝ in rubber V-belt, run on 6 in O.D. and 5.88 in O.D. pulleys 1,250 r.p.m., 2 per cent slip.

face adhesion alone, depends greatly on surface condition and will diminish in the course of time unless restoratives are used, and these are only partially effective in most cases. The high tractive power caused by wedge action makes it possible for the belt to run unusually slack. Hence take-up and center adjustment need occur only at rare intervals. A certain automobile manufacturer goes so far as to state in his instruction book that the V fan-belt needs no adjustment whatever. In any case, idlers or other tensioning arrangements are entirely unnecessary.

These advantages have been enough to cause an almost phenomental rise of the V-belt drive. The very rapidity of introduction made it questionable, however, whether load and diameter standards were being adopted which would guarantee long belt life and freedom from trouble.

A multitude of tests have, therefore, been carried out on the endurance testing machine previously described (A.M.—Vol. 76, page 360). Details of the methods employed are also outlined in this article. As many of these tests were executed for commercial concerns, they cannot here be reproduced. However, since an extremely serious influence of pulley diameter and load on belt life was discovered, it is to the interest of both belt makers and belt users that this influence be emphasized. Thus irrationally arranged drives may be avoided. The writer therefore welcomed the opportunity offered him by the editors of the *American Machinist* to carry out certain tests on the product of a concern to which he was under no obligation. It so happens that this product shows extreme sensitiveness, particularly to small pulley diameters. There are belts which stand up a great deal better. However, for the belt user who buys belts promiscuously, the safest thing may be to note the qualities of the most sensitive ones. From this point of view, the results here published are worthy of attention.

In order to obtain results within a reasonable time, it was necessary to use throughout the tests conditions which were known to cause excessively short belt life. In the load tests, this condition was an unduly small pulley diameter; in the diameter tests, it was an unduly high load. The pulley diameter in the former was about 75 per cent of the minimum necessary for a commercially reasonable belt life. The load in the latter might be characterized as 50 per cent overload, or slightly more.

The effect of variation of load is shown in Fig. 1. It will be seen that when the load decreases from 200 to 125 pounds per belt, the life increases from 6 to 92.5 hours. By plotting the logarithm of the life against the logarithm of the pull, the exponent of the relation between pull and life may be obtained as the slope of the curve. This has been done in Fig. 2. It will be seen that the points plotted fall nearly on a straight line, the slope of which indicates an exponent of 5.85. In other words, when the pull on the belt goes up, the life goes down with the 5.85 power of the rate of increase.

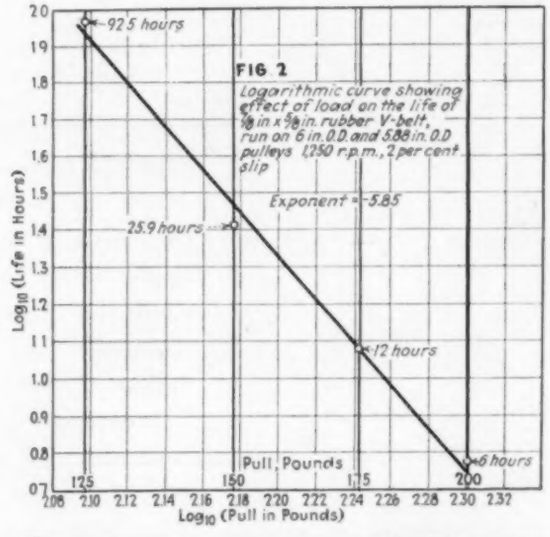


FIG. 2 Logarithmic curve showing effect of load on the life of ½ in x ⅝ in. rubber V-belt, run on 6 in O.D. and 5.88 in. O.D. pulleys 1,250 r.p.m., 2 per cent slip.

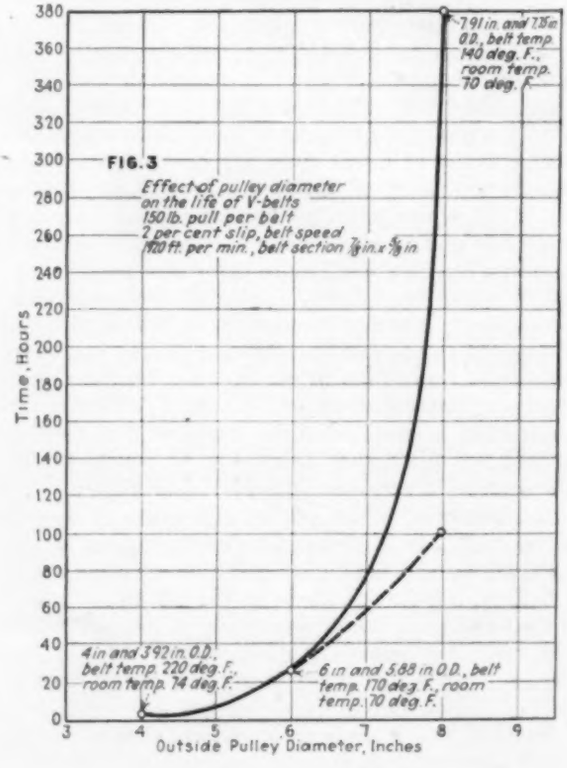

7.91 in. and 7.85 in. O.D., belt temp. 140 deg. F., room temp. 70 deg. F.
4 in and 3.92 in. O.D., belt temp. 220 deg. F., room temp. 74 deg. F.
6 in and 5.88 in O.D., belt temp. 170 deg. F., room temp. 70 deg. F.
Time, Hours
Outside Pulley Diameter, Inches

FIG. 3 Effect of pulley diameter on the life of V-belts 150 lb. pull per belt 2 per cent slip, belt speed 1,100 ft. per min., belt section ½ in. x ⅝ in.

• NEXT WEEK •

Worm drives, so far as the production man is concerned, raise two important problems: that of correct tooling and that of the correct application of these tools. Should a gear hob be identical to the worm? Should it be fed radially or tangentially? These are among the many questions discussed by L. R. Mayo of the Brown & Sharpe Manufacturing Company.

Precise work measurement takes time. But for certain jobs, much of this time may be saved by the installation of gaging devices on the machine tool. Oliver P. Van Steewen tells of German practice in this regard.

The air gun is a familiar tool for applying finishes. In conjunction with automatic work-handling devices, it greatly reduces the cost of these operations. J. A. Paasche describes how metal parts, from flashlight shells to oil drums, are finished automatically.

"Arc Cutting of Metals" and "Efficiency Allowance in Time Study" by Hamilton Smith will also appear.

• IN A. M. •

It should be understood that this exponent may vary with belt design and perhaps with pulley diameters or other factors. Belts with considerably lower exponents have been tested.

In investigating the influence of pulley diameter on belt life, one faces a dilemma. In practice the r.p.m. of the driving and the driven pulley and the horsepower of the drive are usually fixed. If the pulley diameter is increased, the belt speed will increase, and hence if the horsepower remains constant, the effective pull will be reduced. The life of the belt will then be increased both from reduction in pull and from increase in diameter. To avoid this difficulty, it was decided to run the diameter tests at constant belt speed and constant effective pull. This however means a change in r.p.m., and it is possible that this change has an influence of its own on belt life. As a matter of fact, tests which cannot here be reproduced show that, for certain types of belts at least, the life may go down almost with the second power of the increase in r.p.m., effective pull and pulley diameter remaining constant. This is a serious effect. However, it is much smaller than the effect of increased pull. Provisionally, allowances for the variation of r.p.m. may be made on the basis just given.

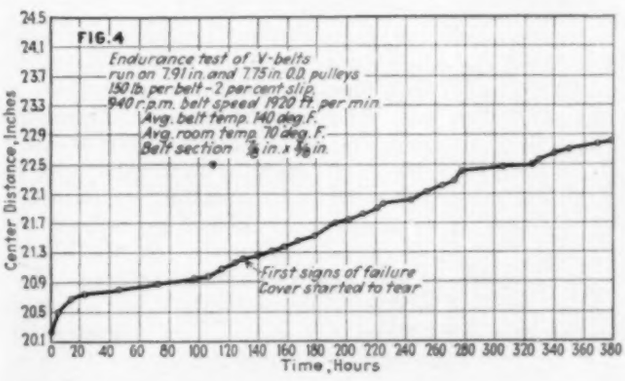


FIG. 4
Endurance test of V-belts
run on 7.91 in. and 7.75 in. O.D. pulleys
150 lb. per belt - 2 per cent slip
940 r.p.m. belt speed 1920 ft. per min.
Avg. belt temp. 140 deg. F.
Avg. room temp. 70 deg. F.
Belt section ⅝ in. x ⅜ in.
First signs of failure
Cover started to tear
Center Distance, Inches
Time, Hours

Results of the tests with varying diameter are plotted in Fig. 3. It will be noted that a dotted and a full-line curve are given between diameters of 6 and 8 in. The reason for this is shown in Fig. 4. The belts tested were of a wrapped type. After somewhat more than 100 hours of running, the wrapping showed signs of failure and the belts began to stretch at an accelerated rate. They ran, however, for over 200 hours more without breaking. Toward the end of this period, the wrapping had been stripped completely off one of them over a considerable distance and the belt was running on the bare cords. Naturally a belt in this condition would never be tolerated in actual power transmission. It is, however, difficult to say with exactness where its useful life should be regarded as ended. From the increased slope of the stretch curve occurring after about 100 hours of running, it is evident that here a progressive destruction of the belt section commences. This might be taken as the end of the useful life. If this is done, the curve of life against pulley diameter proceeds along the dotted line. This is probably the more rational attitude to take. If on the other hand the curve is drawn to the last point of the test—at which as a matter of fact the cord section was not completely broken—the full-line curve applies.

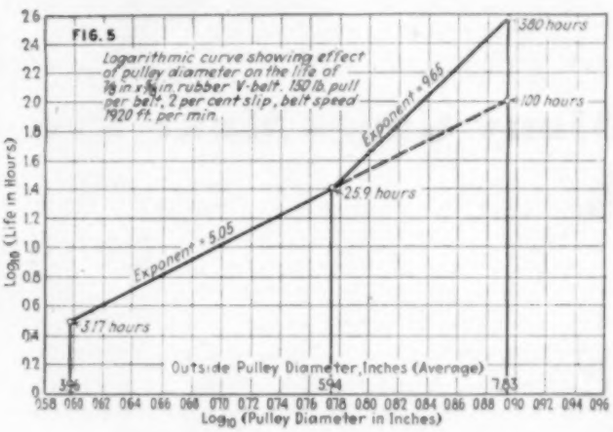


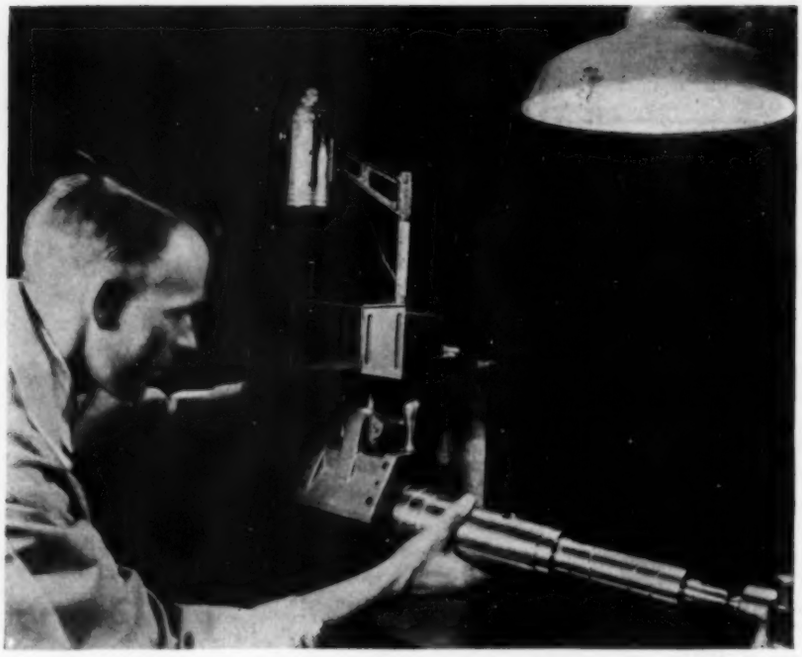
FIG. 5
Logarithmic curve showing effect of pulley diameter on the life of ⅝ in. x ⅜ in. rubber V-belt. 150 lb. pull per belt, 2 per cent slip, belt speed 1920 ft. per min.
380 hours
100 hours
Exponent = 9.65
25.9 hours
Exponent = 5.05
3.17 hours
Log10 (Life in Hours)
Outside Pulley Diameter, Inches (Average)
Log10 (Pulley Diameter in Inches)

Fig. 5 shows that the dotted branch in Fig. 3 gives a constant exponent of 5.05 for the relation of belt life to pulley diameter. This means that the life increases with that power of the pulley diameter.

While the tests here presented do not show it, it is known from other information as well as from general practice that this relation does not continue indefinitely. A point is reached beyond which a further increase in diameter produces little if any further increase in belt life. It is rather evident that for the belt here tested this point is nowhere near reached at a diameter of 8 in. There are, however, other and more flexible V-belts of the same size with which this is much more nearly true.

The main value of these tests, as far as the influence of diameter is concerned, is to indicate the extreme importance of not using pulleys with diameters smaller than those stated by the belt manufacturers to be satisfactory.

The writer wishes to express his appreciation to S. M. Marco, assistant in the Department of Mechanical Engineering of the Ohio State University, for his efficient work in carrying on the routine records of the tests.



Methods of work inspection are dependent on the quantity and nature of the product

Many Gages Make Precise Work

WALTER J. OLDROYD
Mechanical Engineer

EXPERIENCE teaches that the gage used by the workman should not be the same as the one used by the inspector. The difference between the two should be as follows: The workman's gage should have twenty per cent less tolerance than the inspector's. This should not be all in one direction but ten per cent less than the maximum and ten per cent greater than the minimum. There are two reasons for this. The first is, that because of the better judgment of the inspector, he will use the gages with greater care and would reject the piece on which the workman might force the gage if both gages were made the same size. The second reason is, when the workman's gage is worn, it can be reground and used by the inspector, if it has been properly designed.

Here is an example which will explain this system of gaging. The inspector's gage for a $\frac{3}{4}$-in. hole would be 0.750-0.755 in. and the workman's gage would be 0.7505-0.7495, or 0.0005 in. inside of the inspection tolerance. This system has been established by a number of leading concerns.

I have mentioned only the working and inspection gages, but there are two others: the first is a reference and the second a master gage. The reference gage is the check for the accuracy of the working and inspection gages, and the master is to check the reference gages. These last two are not always used. The rate of production and the length of time that component parts are to be manufactured are factors.

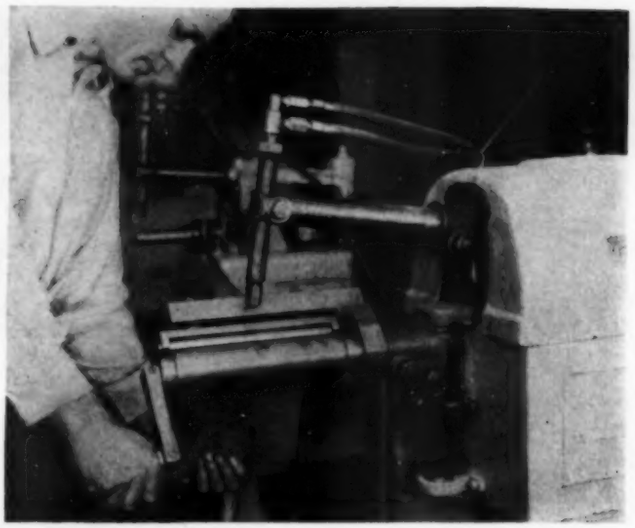
Let us take for example a hole of the dimensions given above. The gage used by the workman and inspector is a plug gage. The reference may be either a ring or a snap gage. It has been my experience that the snap gage is preferable because the plug gage may have flats and still go into the ring gage, but with a snap gage these flat places may be found. A snap gage also enables the gage inspector to determine the size of the plug at both ends. The master for the reference gage should be either a plug, a size block or several size blocks. If the reference gage is a ring, then the master gage must be a plug, but if it is a snap gage, any of the three can be used.

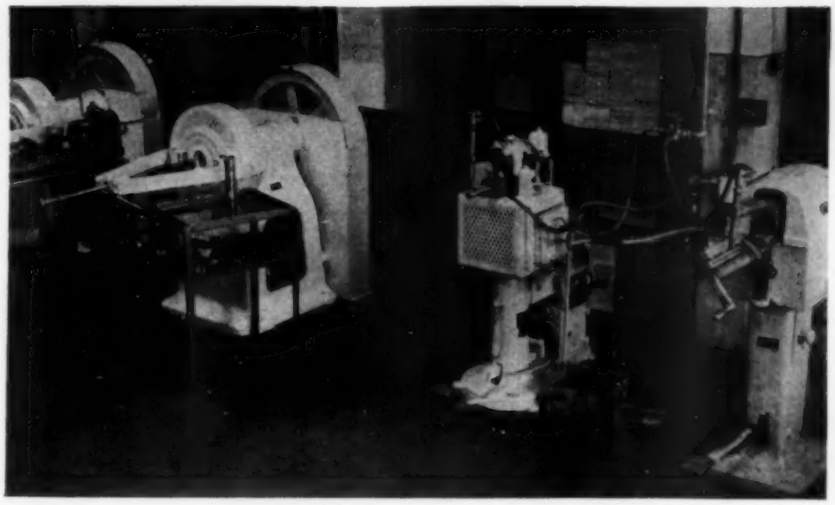
When work goes into the shop, we frequently find that the functioning of the part has not been given proper consideration. The intricate action in a typewriter, fire-arm, watch or the like, does not need large clearances to function properly. Likewise, the bore of a bearing must have some clearance in order to have the shaft that runs in it lubricate correctly.

The type of plug gage which I prefer is a double-ended one, and while it may seem the reason for making snap gages with both limits in the same opening should apply on a plug gage, I have found from experience that it is difficult to lap accurately two diameters on the same plug. And then, too, if an error is made in lapping the second diameter the work in lapping the first is lost.

Flush pin gages are made up in two types: one with a handle, which is complete in itself. In the other a bushing is inserted into a casting or built-up gage. Swing gages are used in similar places to the flush pin gages, and work can be gaged to a much closer tolerance with a swing gage than with a flush pin gage.

In making a toy cannon noise-maker, firing a mixture of acetylene gas and air, one shop found it less expensive to construct the barrel from flat stock, rolled, spot welded and swaged to cylindrical form than to cut off a piece of seamless tubing



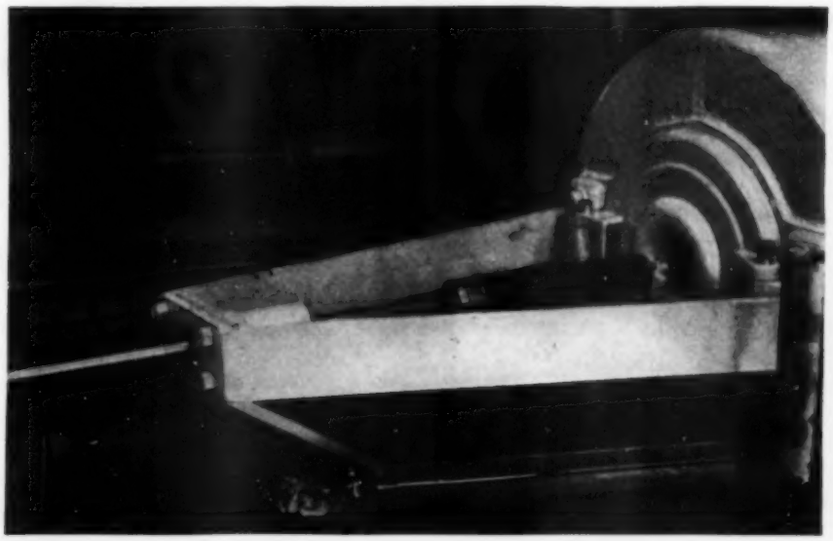


[1] With the aid of a hand crank, the operator winds a flat sheet of blue annealed steel around the mandrel on this spot welder, then tacks it in place at one point of the overlap

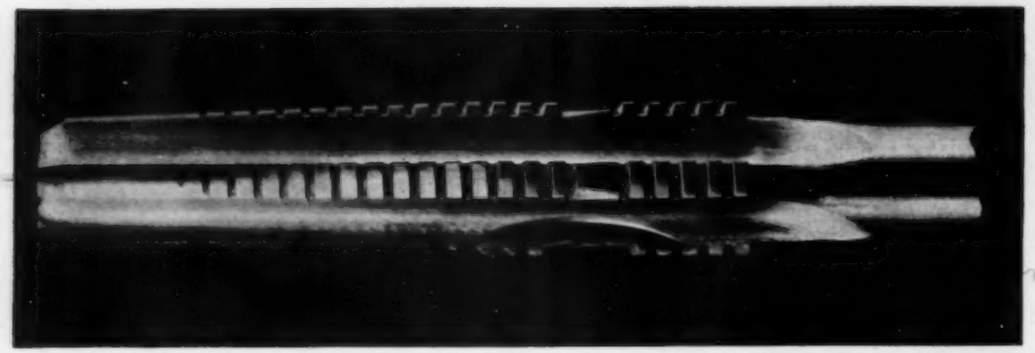
Photographs by courtesy of the Smith Welding Equipment Corporation.

Swaging and Welding Join Forces

[2] A row of spot welds is made at 1-in. intervals on the center machine in this view. The first operation is performed on the machine to the right, the third on swaging machine to left. All machines are painted a canary yellow for cleanliness, cheerfulness and better lighting



[3] The spot-welded barrel, roughly cylindrical in form, is pushed over the mandrel and the lap joint swaged flat. This makes a gas tight joint



Dardelet taps have three sections: the first does the tapping; the second reams the tops of the internal threads; the third does no cutting but merely guides and supports the nut

Taps and Dies for Self-Locking Threads

CHESTER B. LORD
Associate Editor

THE Dardelet thread was designed originally by a French artillery officer of that name for a specific purpose. The French army had considerable trouble with the noses of shrapnel loosening during flight; in some cases the noses fell off entirely.

The trouble was caused by the nose being eccentric or out of balance with the body of the shell or vice versa. A right- or left-handed thread would not solve the problem because it could not be foretold whether the nose or the body was out of balance and hence the direction of rotation of the nose could not be anticipated. That is the story anyway.

Dardelet designed a thread that would get tighter as it unscrewed by having the minor diameter of the nut bear against a taper on the minor diameter of the bolt, and the major diameter of the bolt bear against the major diameter of the nut. In other words, he designed a modified Acme thread with a tapered bearing on top of both the male and female threads. Mathematically, this thread solved the problem, but mechanically it was found impossible to get the desired bearing on both diameters of nut and bolt. Off-lead variations also caused complications. The threads were next provided with a longer taper; in fact the thread was tapered its entire width with an angle less than the coefficient of friction. The results of this change were not favorable because, if the female was made slightly oversize or the male undersize, the nut would pull over the upper end of the thread when screwed down tightly. Finally a bolt and nut were designed with different shaped threads. The male thread is a modified Acme with a 6-deg. taper below it—assuming the bolt to be standing on its head. The nut has a somewhat larger, practically square-sectioned thread with a corresponding 6-deg. axial taper on its inner surface. The direction of these tapers is such that they resist unscrewing. Dardelet nuts are tapped in the usual way; bolts are threaded with chasers.

Because of the necessarily short axial taper on the bolt thread, such tolerances as are permissible on U. S. type threads are out of the question. Because of this necessary accuracy, certain refinements have been introduced in the manufacture of the taps and chasers that insure accuracy of the bolts and nuts with no more care than is necessary with standard threads.

Mechanics who are skeptical about the possibility of maintaining the accuracy necessary to insure a locking fit between the Dardelet nut and bolt are not to be blamed for their doubts. I confess to the same attitude previous to my visit to the company's laboratory. The reason a Dardelet thread can be produced with greater accuracy and less variation than standard threads is primarily because both the nut and bolt have a single accurate dimension, and a bearing on a single surface. Secondly, because of its form and pitch, there is more chip space and little or no tendency for the tap or chasers to tear off the crown of the thread. Thirdly, it is because of the care taken in making taps and chasers.

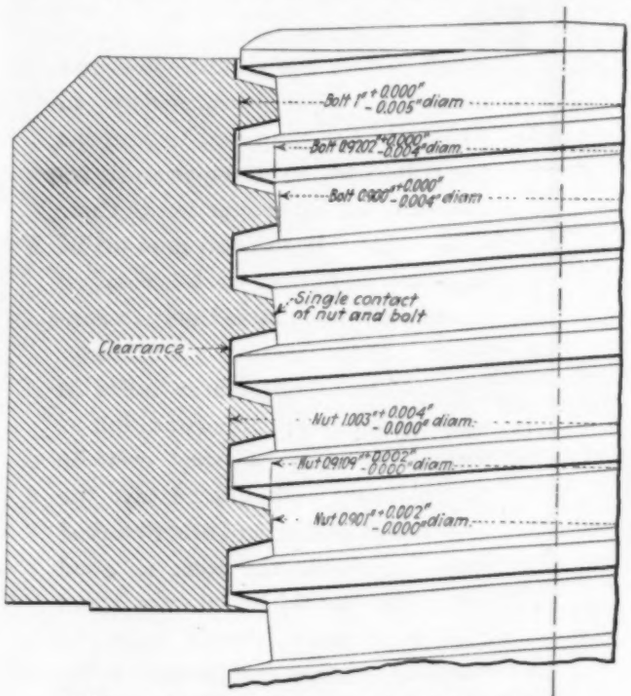
Those who doubt draw upon their practical experience of trying to drill a uniform-sized hole and declare either that the variation in the holes, even if reamed, would be fatal to such an accurate fit on the minor diameter as is necessary, or that even if possible, the cost of doing it would be prohibitive. But this is not true; drilling and tapping are done by ordinary shop methods. I saw a bent-tap machine picking blanks from the hopper and tapping them at the same rate as ordinary standard nuts would be tapped.

The hole in the nut is drilled slightly undersize, as near 0.005 in. under as possible. The thread is cut and the inner or minor diameter reamed afterward, both in the same operation.

To do this, the tap is divided into three parts. The end of the tap is made in the ordinary way, except with more care. Next to this is a reaming section that reams the taper on the inner diameter of the thread. Back of this are several non-cutting threads that act as a lead-

screw for the reamer after the tapping threads have passed through the nut. The tap has four flutes, and each cutting edge of the reaming section is ground to a different distance from the axis of the tap. The first cutting land may remove 0.002 in. or more, the second and third lands the rest, and the final land will merely scrape and size the taper. The other surfaces of the thread are not touched during the reaming operation.

On the larger-size taps the action of the entering angle and the cutting of the leading threads has been given much study. Each of the first eight lands, or two complete turns of the tap, has a different cross-section and cuts a different section of the thread. The width of the space between Dardelet threads is about twice the width of the thread itself. The material to be removed by the tap is therefore considerably greater than in ordinary practice. Hence the care taken. To prevent the tap from reaming or gouging, the first thread has a narrow, deep land that will bite in quickly. The care, accuracy and attention to detail given to the making of taps and chasers plays a large part in the efficiency


Bolt 1" +0.000" -0.005" diam
Bolt 0.9207" +0.000" -0.004" diam
Bolt 0.900" +0.000" -0.004" diam
Single contact of nut and bolt
Clearance
Nut 1.003" +0.004" -0.000" diam
Nut 0.9109" +0.002" -0.000" diam
Nut 0.901" +0.002" -0.000" diam

Tightness is insured by the wedging action between the tapered roots of the screw threads and the inside diameter of the nut. The design demands unusually close tolerances

of the thread. Making the taps is not a complicated nor unusually accurate job aside from grinding the reamer section. The fact that the thread has but a single vitally accurate dimension simplifies the problem greatly.

The taps are milled on a Waltham milling machine and backed off on another Waltham machine in the usual manner. The taper reaming section is ground on a machine built by Waltham for the purpose, and equipped with Bausch & Lomb optical measuring instruments. This grinder is highly special in that its grinding head must have a longitudinal movement timed with the revolutions of the thread, and a timed return in the other direction. The grinding head or saddle must also have a cam motion crosswise of the bed to grind each of the four lands of the reamer portion of the tap to a different radius, and at the same time relieve the land. The machine has micrometer setting gages that allow of adjustments to 0.0001 in. The height of each of the four reaming lands is checked with the Bausch & Lomb optical micrometer, and is afterward checked in an optical thread comparator with a magnification of 1,000 to 1, made by the same company.

Small nuts are tapped in an automatic tapping machine using a bent tap. This is not as simple as it seems when we remember that because of the tapers, a Dardelet nut will go on a bolt in only one direction. It is impossible to make the automatic feed of the tapping machine pick up blank nuts always with the same side up, so it is allowed to pick them up promiscuously and the contact surface is faced as part of the tapping operation.

Even though tolerances are much closer than with standard threads, inspection is much simpler and is positive. Either the nut fits or it does not; there is no necessity for classifying different sizes. One doesn't get something for nothing in mechanics, any more than anywhere else, and the lack of variation in size is accounted for by the pains taken in making the taps and chasers. The ease of inspection is inherent in the design. A Dardelet nut will go on the bolt only one way, when the tapers are parallel. If the nut is turned upside down, the maximum diameters of both tapers come together and the nut will not go on. If it does go on, the bolt is undersize or the nut is oversize and useless.

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Salvaging Worn Bushings

Discussion

J. T. TOWLSON
London, England

BEING frequently faced with the problem of reconditioning worn bushings, I have always adopted the replacement plan, not daring to accept the reasonableness of the method described by F. W. Cheatham in an article under the title given above—(*AM*—Vol. 75, page 953). Referring to Mr. Cheatham's article, it will be seen that he has reconditioned badly worn bushings by upsetting them in a hydraulic press, and has succeeded in expanding the metal inward so much that the bushings required to be rereamed.

To be able to recondition badly worn bushings by such a method really opens a substantial means of reducing the cost of upkeep of the associated parts, such as the ends of connecting rods. The writer, intensely interested in such a cost-reducing scheme, is desirous of giving it an exhaustive tryout. In the meantime, information regarding successful cases would be a real help. What would Mr. Cheatham designate as a badly worn bushing?

Since wristpin bushings often need reconditioning as the result of elongation of the bore, I am anxious lest such elongation cannot be adequately reduced by upsetting. I am afraid that the shortening of the elongated bushings would be too great in effecting the necessary "squeeze-in." I am wondering, too, how Mr. Cheatham makes such excessive shortening of the bushings to be of so little consequence. As a maintenance man, I have always understood that the length of a bushing should be such as to just allow a working clearance between its ends and the adjacent surfaces on each side.

EXECUTIVE FORUM

Piecemeal

BOB BRADFORD, purchasing agent of the Express Machine Company, entered Bert Jenning's office with an invoice in his hand and fire in his eye. Like many other purchasing agents, Bradford made a daily practice of scrutinizing each invoice carefully. He was quick to notice any that appeared to be out of line.

"No wonder we can't make any money—just look at this," he said indignantly, laying the invoice on the works manager's desk.

Jennings looked over these figures:

Size	Grade & Purpose	Weight	Price	Amount
1 pce. 7/16 Rd.	Cold Drawn	3½	28c.	.98
	Size		7c.	
	Quantity		5c.	.42
	Burlapping			.25
				1.65
	Pittsburgh Frt. equal			.01
				1.66
1 Bdl. Burlapped Parcel Post & insurance				.15
	Order Complete			1.81

"Well, what's wrong?" he asked.

"What's wrong," repeated Bradford, "I can get an automobile ready to drive for about 20 cents a pound. Why should we pay 52 cents a pound for cold drawn steel?"

"If you buy your car one spark plug at a time, you won't get it for 20 cents a pound," said Jennings. "And you can't expect a 3½-lb. bar of steel at carlot prices."

"I expect to pay more for a small piece," said Bradford, "but I don't like the way this bill is made out. This supplier has added in everything but his telephone number. The 28-cent price is high enough without all the rest of the items for packing and shipping."

"You know I'm just as interested in low costs on our product as you are," said Jennings," but I see the other side of the picture too. We get lots of small repair orders that cost us more to ship and bill than the charge to the customer. Here are some figures on office costs for small orders I ran across the other day: Recording, 88 cents; billing, 82 cents; credit work, 97 cents; collection, $1.01. In fact, the collection charges on small items are greater than those on large orders. The trouble with us is that we lack the courage to collect our actual costs."

"We're not helping the situation much by buying 52-cent steel," said Bradford.

"We're simply making the choice between a very low inventory and high prices for retail quantities. The main idea today is to buy materials only against actual sales. But I believe that we and a great many other concerns have carried this policy too far."

"After writing off that inventory left over from 1929, I hate to think of building up another. Maybe it's best to charge the loss on small orders up to service."

Small orders are troublesome and expensive. They are costly to handle in the shop and to prepare for shipment. The paper work involved is out of proportion to their total value. If the full amount of handling and paper work is charged to the customer, he is likely to consider the invoice exorbitant. Should the manufacturer suffer in silence and accept this condition as one of the many "service" costs he has to bear? Should he save the expense of billing and other clerical work, charging the item to good will? Or should he take the stand that each order should carry its share of expense and invoice on the basis of his actual costs? What do you think about this problem?

"Perhaps we shouldn't charge them at all," said Jennings. "At least one company I know of has cut out billing all shipments under one dollar."

"How do they collect?" asked Bradford.

"They don't," said Jennings. "They present the part to the customer with their compliments. It cultivates good will and actually saves the company money."

"This steel supplier evidently hasn't heard of good will," said Bradford. "Instead of giving us the steel, he's doubled a price that's high in the first place."

Discussions Of Former Subjects

Personality Plus

To us the salesman is a chief source of information. We men who are inside all the time depend upon two things to keep us informed. The first is the trade journal, the second is the right kind of salesman.

We want facts and details. The average salesman has not the opportunity of selling us something very time he calls, but he can build up enormous good will by going out of his way to supply us points that will help us do our jobs better.

The glad hander is gone. In his place is the clean-cut, alert man, young or old, who is not afraid to tell us when we are wrong. This man sells us what we should have, not what we want. He is our friend and adviser. —E. F. WERNER, *Superintendent, American Fixture & Showcase Company.*

The Up Grade

Were I to choose between a man of technical training and one trained through the school of hard knocks, providing both were equally well equipped, I certainly would promote the technical man, as he would in all probability rise further. There would still be room for the shop-experienced man later on. I base my opinion on practical experience, for at one time I was employed by a company where another man, one with a college education, and myself were assigned to the same type of work. There was an opening for advancement, and I naturally thought that I should be in line for the job, as I had more practical experience than the other, had been with the firm considerably longer, as well as being considered one of the boys. But things did not come my way and the other fellow got the job.

I felt pretty badly put out by it for a while, but after thinking things over I came to the conclusion that it was all for the best, a conclusion that in later years proved itself. The other man did not stop at this one promotion but went along way up to the top, something which I would have been unable to do.

The college trained man, if he has any ability at all, has a distinct advantage over the shop trained man for the bigger positions. But if a position that is open is a dead stop, or is far as the holder can go, then by all means give it to the practical man if one is available, as he will be better fitted to hold it, for the technical man will never be satisfied once the limit is reached. Both types of men have their uses, but the shop man must not feel he is being discriminated against when a technical man is promoted over him, for the chances are that there is some job further on that he could not handle. Therefore he is much better off where he is.

—CHARLES R. WHITEHOUSE, *Standards Engineer, The Holtzer-Cabot Electric Company*

Rolling Stones

A young man who serves his apprenticeship, be it executive or in the trades, should get out and take another position. The hard knocks will be the best thing that could happen to him. While serving his time, every one feels kindly toward him and helps him too much. After his time has been served, the rest of the men still look on him as an apprentice. When he enters the employment of another company he is looked upon as a journeyman, which will bring out the best that is in him.

It is true that some few companies are taking advantage of trained men from other companies. But these men never forget the company which trained them and will easily repay the cost of their training by good will or the purchase of some equipment.

—J. C. WATSON, *Master Mechanic, Franklin Pottery.*

Self-Contained

Firms, whose entire product passes through a single machine or process, have little choice as to whether or not they can employ outside contractors to attend to their breakdowns. Breakdown, necessitating continued inaction of that one vital link, may result in stoppage of the entire works. In such cases, it is essential to have, in the plant, a maintenance staff capable of dealing with at least the simpler breakdowns. The maintenance staff which is part of the firm's personnel develops a quickness in dealing with the machines under its care that cannot be equalled by contractors.

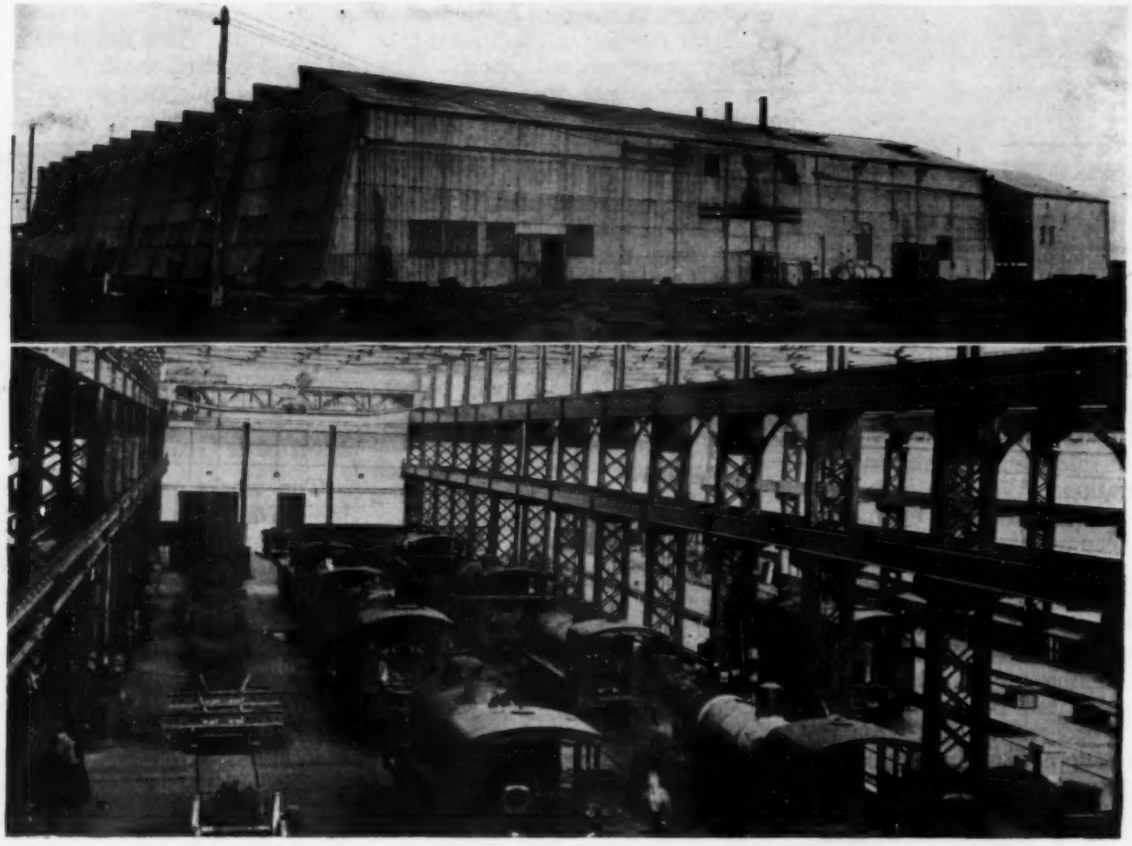
On the other hand, work that can wait for attention—window-cleaning, painting, repairs to buildings—is best given to contractors, unless the firm is of such a size that a number of men can be continually employed on such work. —A. W. KNIGHT, *Ipswich, England.*

Iron and Gold

The works manager has no real basis for comparing the outsider's quotation with the cost of his own foundry except in the remote probability of production and accounting methods being similar. The writer, in his purchasing experience, has had to do some of this sleuthing and has found it a good rule to consider all angles before jumping at conclusions. Quotations from a new source of supply will not infrequently be made purposely low with a view to getting in. Also, not being as familiar with the complete assembly as the insider, the builder may count on cutting quality. Furthermore, while the intentions of the boss are good, he sometimes fails to give all the necessary specifications. Recently the head of a concern became much exercised because he had obtained a quotation on a certain article at about one quarter of what it was then being purchased for. But he had neglected to say anything about one necessary requirement—that of being moisture proof.

It is profitable to treat the foundry as a separate unit but to sell castings to the parent company at cost. What goes into that cost is a matter to be determined by each concern, but why add a separate profit any more than you would to the process of machining or assembling. Development should be an engineering expense as changes are mostly caused by working from one conclusion to another on the part of the engineers. When the foundry is considered a separate unit, it is not logically, with all due respect to the accounting department, all one company. Its status is similar to that of other sources of supply, and to the cost of the castings should be added only whatever burden is added to the cost of other materials purchased elsewhere.

—H. D. MURPHY.



Above—The foundry, 195x290 ft., has a saw-tooth roof and windows near the ground. Each end of the building slopes outward to permit housing of molding and other machinery at the ends of the floor, but not interfering with it. Core oven stacks may be seen near the center of the building

Below—An entirely different type of construction is used in the new erecting shop. The two 75-ton cranes are on the upper runway, while a 10-ton unit has an independent runway lower down. Excellent light distribution is obtained with the saw-tooth roof in spite of the height of the blank walls

Locomotive Shops in Australia

Australia is a comparatively new country but has been interested in machine tools and machining for some 70 years. Examples of a modern locomotive shop there are shown in these views of Walkers, Ltd.

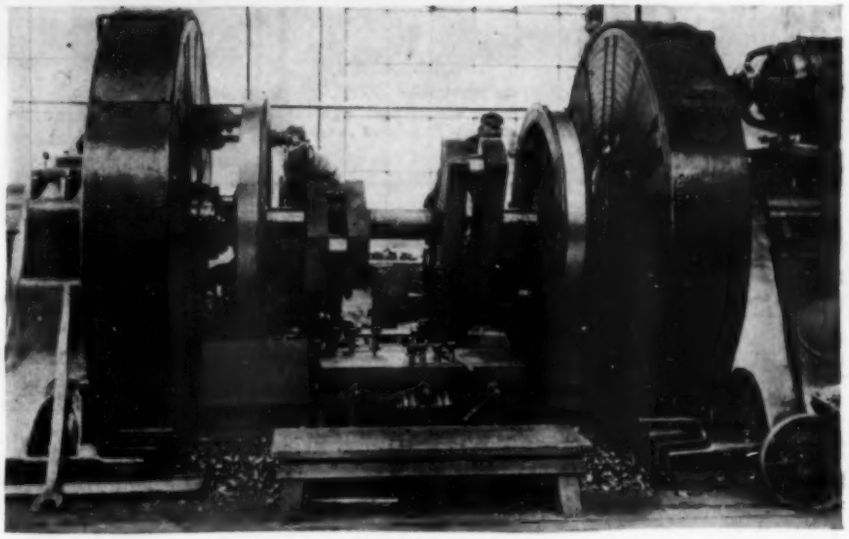
AUSTRALIA is such a new country so far as machine development is concerned that it is something of a surprise to discover how long it has actually been interested in machine shops and their work. It would probably be difficult to establish the date of the first shop, but Walkers, Ltd., from whose plant the accompanying illustrations were secured, dates back nearly 70 years, to 1864 to be exact.

Beginning in a small way they progressed slowly, as in all new countries, but executed an ever-increasing number of large contracts for machinery of various kinds. The once famous gold fields of Australia, with their demands for boilers, engines and other machinery used in mining, were responsible for the founding of the company. Close on the heels of the gold mining came the cane sugar industry, then in its initial stages. These two industries are responsible for the location of the original plant in Maryborough, Queensland, this being near the greatest market for the machinery required at that time.

Walkers, Ltd., grew both in size and in the variety of its product, and in the early 90's turned its attention to the building of locomotives. This new line brought considerable business, and it became famous in all Australia. In 1896 its first large contract was secured from the Queensland government for the government railways, the locomotives being 3½ ft. gage. This contract was the beginning of an almost unbroken sequence of locomotive orders. In the following 32 years, more than 500 locomotives were built, some at the high rate of one every four days.

Such an output necessitated the organization and building of a suitable plant at Newport. The plan called for dividing the work into two parts, one for

Above—The boiler and tank shop is of the same type as the others. In addition to the traveling cranes, jib cranes aid in special operations. Mud rings, fire-box ends, and the boiler shell in the rolls near the center of the shop show the nature of the work handled



Right — The machine shop has light at the side as well as above, and has ventilating-type windows. Here a large driving wheel lathe is at work on a pair of tires mounted on a cranked axle for an inside connected locomotive

boiler and plate work and the other including pattern shop, foundry, machine and tool departments, erecting bays and power plant. Executive offices are also in this section. The 1,380-hp. power plant supplies the needs of the whole works. The main plant consists of two 400-hp. diesel engines with direct-connected generators, while a standby plant of three suction gas engines, also with generators, makes up the total. The machinery is driven by the group system with motors of suitable power at necessary points.

Buildings cover 12½ acres, and in addition other land has been utilized in building sea-going vessels up to 6,500 tons capacity. Two steamers of this size were built for the Australian government. During the past few years Walkers has taken up the manufacture of large diesel engines, being the first in Australia to enter the field on a commercial basis.

The shops are of unusual design owing to the height of the plain walls in connection with the saw-tooth type roof.

The growth in the size of the product as well as in the plant is indicated by the difference between the first locomotive and the latest 2-8-2 built in the new shops and having a tractive power of 47,710 lb. with the booster, and 38,710 lb. without it. These new locomotives weigh 414,400 lb. ready for service.

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Holding Polished Pipe in the Vise
Discussion

MATTHEW HARRIS

IN AN ARTICLE under the title given above (*AM*—Vol. 76, page 515), D. W. Patton tells how to hold polished pipe or rods in the vise without marring them.

Having to hold nickel-plated brass pipe in the vise for cutting and threading, I have always wrapped it with two or three turns of abhesive tape and placed it between two blocks of wood hollowed out to half circles, clamping the whole in the vise. Any sticky matter left on the pipe from the adhesive tape is easily removed with either kerosene or gasoline.

Poorly designed tongs left these marks on the coating of a water pail. Devising better tools for handling work is one of many ways in which mechanical resourcefulness can assist the galvanizing department

WALLACE G. IMHOFF
Consultant in Zinc Coating

Mechanical Aids to Hot Galvanizing

Cooperation by those in charge of mechanical operations and product design will greatly reduce the galvanizer's problems

BEFORE citing actual examples, a word of explanation will be given about the ordinary hot galvanizing department, just what it is doing, and how it is doing it. Contrary to general belief, hot galvanizing is widely used. Since it is a finishing process in many plants, there are thousands of galvanizing kettles in operation that are not listed under the general head of galvanizing. It is usually regarded much the same as other finishing processes, such as painting or enameling.

The countless zinc-coated articles in sight everywhere are an indication that hot galvanizing is a big business. Some of the definite fields of galvanizing are sheets, pipe, wire castings and fittings, pole-line hardware, range boilers and tanks, metalware, fence, nails, structural steel, and the thousands of articles zinc-coated under the general term of miscellaneous and job galvanizing.

In small shops, all departments are brought in closer touch with each other; in large shops, there is a much greater chance for losses with unseen and unknown factors to affect the galvanizing department. Because all previous work done on an article and even the material itself may be scrapped and lost if the article is spoiled in the galvanizing department, close cooperation and harmony with the other departments is essential.

Zinc will not adhere properly to steel in the black form as fabricated. In many of the operations where forming, stamping, drawing, drilling, and other operations are necessary, lubricants, oils, and drawing compounds of one kind or another must be used. Iron oxides and scale on the steel are removed by pickling in sulphuric or muriatic acid, but if the work is covered with oil and grease, the acids will not attack the surface uniformly, and the result is that some parts will be burnt, or overpickled, and other parts will not be pickled enough.

It is a good general practice to remove all traces of oil and grease by first putting the work through a good commercial cleaning bath before putting it into the pickle. The cleaning bath is usually alkaline, so that the work should be washed thoroughly in hot water after cleaning. A large amount of cleaning solution carried over into the pickling solutions will neutralize them and cause unnecessary waste of acid.

After the work has been through the cleaning bath and the entire surface is absolutely clean, it is ready for pickling. The pickling solution is usually a solution of sulphuric acid of varying strength according to the kind of scale to be removed. The average strength is about 4 per cent, used at a temperature of 160 to 180 deg. F.

Heavy blue scale on forgings requires a stronger acid solution than some of the lighter scales such as are found on sheets. As a general practice a material called an inhibitor is used in the pickling bath so that the acid will not be wasted in unnecessarily dissolving the steel base once the scale is removed. This material will allow the acid to operate on the scale, but prevents it from attacking the steel.

After pickling, the article may or may not be dried. It is first given a thorough rinsing and may be stored for a couple of hours in water tanks. This is for the purpose of removing any gas that may have gotten into the pores of the steel during pickling. Some material can be coated fairly wet; other materials such as sheets go through rolls to take off the excess water and acid; and still other materials such as castings and fittings are dried before going into the zinc bath.

The Flux Treatment

Articles must be given a flux treatment before they are put into the molten zinc. With some kinds of work, this consists of a liquid flux dip plus a passage through a molten slag flux on the bath itself. Different treatments are required for different kinds of work. The purpose of the flux is to keep the molten zinc from spattering and blowing out over the operators. The slag flux on the bath also tends to take up all the water before the steel goes into the hot zinc below. It also pre-heats the steel so that it is in better condition to enter the zinc.

The zinc bath is usually held at 850 to 875 deg. F. depending upon the class of work and the production going through the bath in a given time. Large production will sometimes necessitate a bath temperature as high as 880 deg. F. while slow work, such as range boilers, may require only a bath temperature of 835 to 850 deg. F. Metalware articles, such as water pails, may be coated at a bath temperature of 865 deg. F. while tubes will require a slightly higher temperature, 870 to 875 deg. F.

The weight of the zinc deposited and the finish of the coating are greatly affected by bath temperature. A high temperature tends to give a bright, smooth coating, but if it is too high for the gage of steel, the coating may burn white. Flux spots and other defects are much affected by the temperature carried, as well as the dross and other by-products produced. Pot life, metal condition, and a host of other things change the process from what appears to be a simple task of putting the work in one end and taking it out the other, to a really definite and scientific art.

Some work is air-cooled, some given a dip in water, and some cooled by passage through a water bath with oil over the surface. This divides the finish into two large general classes: the one with a spangle, or crystalline effect; the other with just a smooth uniform finish. Both classes of finish have their place.

Machinists have a wonderful opportunity to assist the hot galvanizing superintendent or foreman. Various kinds of tools are required in the galvanizing and pickling departments, dies are required in the black goods and forming departments, and there is abundant opportunity to invent special tools and equipment for easier handling, increasing production, or giving better quality work.

The illustration shows a typical result of poorly designed withdrawal tongs for use in taking out water pails. A large uncrystallized spot was left on each pail where it was grasped and held by the tongs in drawing it out of the zinc bath. One day the galvanizing foreman and the machine shop foreman got their heads together and decided to eliminate all these spots on pails, tubes, and other work. The tongs used had a large flat end on it where it held the pail, and this cold steel coming in contact with the soft, uncrystallized zinc, chilled it quickly and stopped the formation of spangles. In many cases, it also actually tore off the soft zinc coating which stuck more tightly to the tongs than it did to the side of the pail.

The foreman of the galvanizing department explained the whys and wherefores of what was happening, and the machinist foreman came back in an hour with an entirely different type of tong that took hold of the pails at the top and bottom rims and did not touch the open side space at all. In less than a year, every tong in the galvanizing department had been redesigned so as to avoid marking the soft coating.

One of the serious troubles in hot galvanizing is the lodging of flux in open seams. The flux will take up large quantities of water when cold and will absorb moisture from the air. This excess flux, which is acid in character, then runs out from under the seams and down over the good coating, attacking it and destroying the finish. Work that is put in storage in perfect condition may have to be sold as seconds six months later because of this flux run out from under the rims and seams.

In the small shop, the machine shop foreman can render excellent service by watching the dies in the black department and seeing that they are set so that the seams will be rolled tightly preventing the entrance of flux.

Open Seams Make Trouble

It is not possible to solder with zinc as many believe. Galvanizing is not a soldering process, and where there are open seams it is extremely difficult to make the zinc fill them. The molten flux lodges in the seams first, and the gas released by the flux forms a pocket, the pressure holding out the zinc and keeping it from making a good coating.

The engineering department can also render great help by so designing articles that there will not be any open seams and also so that there will not be pockets under rims, or angles, where the flux can get in and keep the zinc out. One basic principle of design for all work that is to be hot galvanized is to have free access in and out for the metal. Parts should be so designed that the zinc can flow in freely and at the same time all liberated gases can flow out through another opening. If work is not designed right, it makes it extremely difficult for even the best galvanizer to coat it perfectly. In addition to flux lodging in the openings, there is danger of explosion and of having zinc pools lodge and freeze in the inaccessible parts.

Probably one of the most fertile fields in which the machine shop can work with the galvanizing department is in the construction of hooks and racks for both pickling and galvanizing. In a number of cases a substantial increase in production has been brought about by the development of some special hook, or rack for the pickling department, or for hanging the work on when it is dipped in the pot.

In a range boiler and tank shop, a special chain with three hooks on it was developed for pickling three boilers at a time. In a pole-line hardware plant, a special holder was developed for pickling clamps. Each rack held 40 clamps and then 20 racks were placed on a pipe at one time, giving a production of 800 clamps at one pickling.

In still another plant, a special half mold was made for catching the used flux.

A practical application of the savings that may be made with a little cooperation from the machine shop is shown in the design and construction of the dross spoon. In one plant the dross spoon in use had small ¼-in. holes spaced about six inches apart. By simply increasing the size of the holes to ⅜ in. and putting enough holes in the spoon to make them only one inch apart a considerable saving was made in the quantity of dross produced.

Perhaps there is no industry that has received so little careful study as that of galvanizing. It is only in the last few years that pickling machines have begun to appear. There are many opportunities for the development of methods and equipment to better hot-galvanizing procedure.

Better Welding Practice

As summarized in papers presented at the annual meeting of the American Welding Society in New York, April 27 to 29

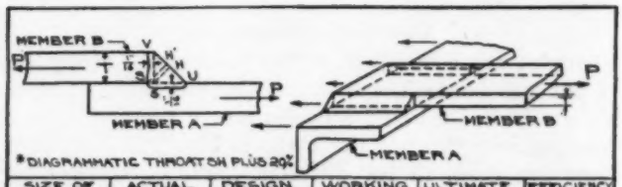
CAPT. J. O. GAWNE, U. S. Navy, explained that use of arc-welding in the construction of naval vessels has been one of the most outstanding developments in recent shipbuilding practice. While in new vessels riveting is still used for connections of ballistic plating and main strength member, welding has replaced riveting in other parts of the structure and in practically all fittings.

The "Salt Lake City" and "Pensacola," first 10,000-ton cruisers built under the Washington treaty, were the first warships on which welding was applied to any considerable extent. It was used for less important structural members and for a large number of fittings. Now, in the construction of the "New Orleans," four gangs of riveters and 28 electric welders are at work. In the corresponding months on the "Pensacola," eight electric welders and fourteen gangs of riveters were at work.

Test specimens, made entirely of weld metal deposited with heavily covered fluxed electrodes, are giving ultimate tensile strengths of 70,000 lb. per sq.in. and elongations of 25 per cent. Test specimens of weld metal deposited with bare electrodes are giving ultimate tensile strengths of 60,000 lb. per sq.in. and elongations of 8 to 10 per cent.

Before being allowed to work on naval construction, welders must pass a qualification test by welding three butt joints in medium steel plate, one in the flat, one in the vertical and one in the overhead position. Tensile strength of these joints must average 52,000 lb. per sq.in. and none must be under 45,000. Common values are 55,000 to 65,000. In addition to this, a factor of safety of 1.44 is used in the design. According to Captain Gawne, the preference is for a.c. driven welding equipment because of the slightly lower first cost and considerably lower maintenance cost.

In "Welded Barge Construction at Federal Shipbuilding & Drydock Company," Gordon G. Holbrook discussed the trend toward welding in commercial vessels. He explains that recently a revival of constructive welding in shipbuilding has taken place but at a much more conservative rate than that at which welding was first



*DIAGRAMMATIC THROAT OH PLUS 20%

SIZE OF WELD AND THICKNESS OF BASE METAL "T" (INCHES)	ACTUAL LENGTH OF THROAT S H (INCHES)	DESIGN ULTIMATE VALUE PER LINEAR INCH OF WELD, IN DIRECTION P	WORKING VALUE PER LINEAR INCH OF WELD, WITH FACTOR OF SAFETY OF 4.	ULTIMATE VALUE OF BASE METAL IN DIRECTION P AT 60,000 LBS. PER SQ. IN.	EFFICIENCY OF WELD IN TENSION OR COMPRESSION (PERCENT)
1/8	*.1061	2,700	675	7500	36.00
3/16	*.1591	4,051	1012	11250	36.00
1/4	*.2122	5,401	1350	15000	36.00
5/16	*.2652	6,751	1688	18750	36.00
3/8	.3094	7,876	1969	22500	35.00
7/16	.3536	9,001	2250	26250	34.29
1/2	.3977	10124	2531	30000	33.75
9/16	.4419	11,249	2812	33750	33.33
5/8	.4861	12,374	3094	37500	33.00
11/16	.5303	13,499	3375	41250	32.72
3/4	.5745	14,624	3656	45000	32.50
13/16	.6187	15750	3938	48750	32.31
7/8	.6629	16875	4219	52500	32.14
15/16	.7071	18000	4500	56250	32.00
1	.7513	19125	4781	60000	31.88
1 1/16	.7955	20250	5062	63750	31.76
1 1/8	.8397	21375	5344	67500	31.67
1 3/16	.8838	22501	5625	71250	31.58
1 1/4	.9281	23626	5906	75000	31.50

DESIGN ULTIMATE STRESS IN WELD METAL IN TENSION (COMPRESSION = 36,000 #/□"; IN PARALLEL SHEAR = 25452 #/□"

Table I—Strength per linear inch of fillet welds in tension, compression and parallel shear, and efficiency in tension and compression

adopted. In large vessels, electric welding has been principally in the design of minor parts and fittings. In the design of small craft, several methods have been employed to realize the benefits of welded construction. Present designs permit use of full automatic welding in important shell and deck seams of barges and similar vessels. From 67 to 80 per cent of the entire welding on a barge may be done in this manner. The welded metal is less subject to corrosion than the rolled metal in the joined members. Hand welders at this company use d.c. equipment and bare wire electrodes to attain tensile strengths of 45,000 lb. to 50,000 lb. per sq.in.

Leon C. Bibber, discussing "The Experimental Determination of the Values of Fillet Welds in Tension," summarized his results in Table I. His tests indicate that values for fillet welds calculated as shown in Fig. 1 and those obtained from actual test check sufficiently closely to justify the use of this method of calculation.

James Aston, of A. M. Byers & Company, discussing "Welding of Wrought Iron Pipe," explained that wrought iron, during the past few years, has been put

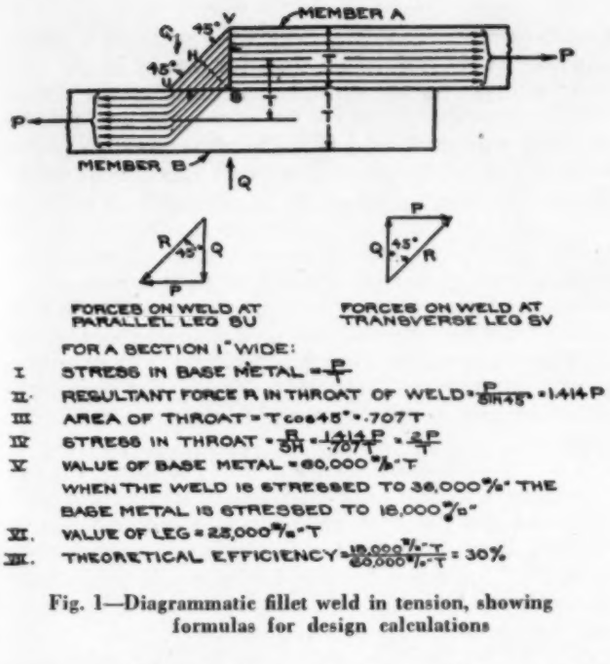

MEMBER A
MEMBER B
P
Q
45°
FORCES ON WELD AT PARALLEL LEG SU
FORCES ON WELD AT TRANSVERSE LEG SV
FOR A SECTION 1" WIDE:
I STRESS IN BASE METAL = P/T
II RESULTANT FORCE R IN THROAT OF WELD = P/sin45° = 1.414P
III AREA OF THROAT = T cos45° = .707T
IV STRESS IN THROAT = R/SH = 1.414P/.707T = 2P/T
V VALUE OF BASE METAL = 60,000 #/" T
WHEN THE WELD IS STRESSED TO 36,000 #/" THE BASE METAL IS STRESSED TO 18,000 #/"
VI. VALUE OF LEG = 25,000 #/" T
VII. THEORETICAL EFFICIENCY = 18,000 #/" T / 60,000 #/" T = 30%

Fig. 1—Diagrammatic fillet weld in tension, showing formulas for design calculations

on a plane of manufacture closely paralleling that of steel in tonnage and cost possibilities. The product is already available in the form of plate, sheets, wire, bars and forging stock, in addition to pipe. Alloy wrought iron with improved physical properties is an accompanying development.

The curves in Fig. 2 show strikingly the influence of temperature and pressure in welding wrought iron. The data clearly show that there are critical limits of temperature and pressure below which good welds cannot be made. In order to reach the strength efficiency of 100 per cent, a pressure of 550 lb. per sq.in. must be employed with a temperature of 2,550 deg. F., whereas at a temperature of 2,700 deg. F., a pressure of 275 lb. suffices. While the data apply principally to wrought iron, the fundamental principles are applicable to the entire problem of plastic welding of wrought iron and steel. Naturally, variations of metal composition and other characteristics will modify the critical limits for different types of material.

Electric resistance, spot and flash welding give excellent results with wrought iron. The somewhat higher temperatures desirable are obtained by using higher current densities than those prevailing for soft steel. Fusion welding is applicable to a much wider range of materials and compositions. By reason of this, a union of dissimilar materials may be made, a filler metal may be used unlike that of the materials to be joined, and alloy steels may be united which are non-weldable from the viewpoint of plastic coherence. In welding wrought iron, however, temperatures should be raised somewhat above those causing the first greasy or fluxing appearance.

A puddle of molten metal should always be maintained at the point where the rod is being applied, the end of the rod being kept immersed in this puddle until enough metal has been deposited. Then the edges of the molten puddle and the surrounding colder metal should be fused together to obtain a solid union. The weld progresses by repetition of this procedure, care being taken to add no metal from the welding rod except through the vehicle of the molten puddle.

Carl DeGanahl, president of Fleetwings, Inc., discussed "Spot Welding of Stainless Steel as Applied to Aircraft." His company uses the 18-8 alloy, which has been found peculiarly suitable for spot welding. Copper electrodes are used under sufficient pressure to insure proper contact of the metal. Electric current is turned on for a small fraction of a second only. Thus the metal at this point is heated almost instantly to a fusion temperature, then the heat is conducted away by the copper electrodes, and the surrounding cold metal even more rapidly than the chilling of a body of metal being quenched in water. The result is a tough, malleable weld of annealed metal which gradually radiates out to the hard material unaffected by the heat. Spot welding seems to avoid the breaking down of the alloy structure encountered with torch welding.

Ira T. Hook, research engineer, American Brass Company, discussed "Welding of Extruded Bronze." The oxyacetylene torch is most commonly employed with a large tip and soft flame to prevent breaking up the protective outside coating. The white inner cone of the flame should never be allowed to touch the work as is done in welding steel but should be held $\frac{3}{8}$ to $\frac{1}{2}$ in. above it to heat the work uniformly and give maximum blanketing effect of the torch gases. The oxyacetylene

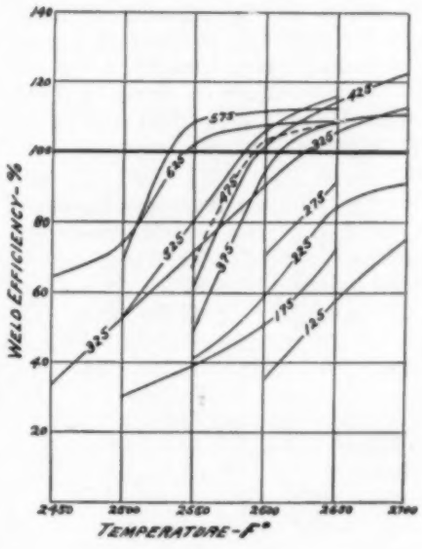


Fig. 2—Relation of weld efficiency to welding temperature and pressure, in wrought iron

Table II—Embossment diameters and heights in relation to thickness of stock being projection welded

Embossments in:		Welded to:											
		20GA—0.0375		18GA—0.0500		16GA—0.0625		11GA—0.125		7GA—0.1875		3GA—0.250	
Gage	Thickness	Diam. of Emb.	Height of Embossment	Diam.	Height	Diam.	Height	Diam.	Height	Diam.	Height	Diam.	Height
20GA	0.0375	3/16"	0.040–0.050	3/16"	0.040–0.050	3/16"	0.040–0.050	3/16"	0.040–0.050				
18GA	0.0500	3/16"	0.030–0.040	3/16"	0.030–0.040	3/16"	0.040–0.050	3/16"	0.040–0.050				
16GA	0.0625	5/32"	0.030–0.040	5/32"	0.030–0.040	5/32"	0.030–0.040	5/32"	0.040–0.050	3/16"	0.040–0.050	3/16"	0.040–0.050
11GA	0.125	5/32"	0.030–0.040	11/64"	0.030–0.040	11/64"	0.030–0.040	11/64"	0.040–0.050	3/16"	0.040–0.050	3/16"	0.040–0.050
7GA	0.1875	3/16"	0.030–0.040	11/64"	0.030–0.040	11/64"	0.030–0.040	3/16"	0.040–0.050	3/16"	0.040–0.050	3/16"	0.040–0.050
3GA	0.250	3/16"	0.030–0.040	3/16"	0.030–0.040	3/16"	0.030–0.040	3/16"	0.040–0.050	3/16"	0.040–0.050	3/16"	0.040–0.050
13GA	0.093	5/32"	0.030–0.040	11/64"	0.030–0.040	11/64"	0.030–0.040	11/64"	0.040–0.050	3/16"	0.040–0.050	3/16"	0.040–0.050

flame is also preferred by Mr. Hook for silver soldering since it provides greater speed, minimum warpage and satisfactory performance. For soft soldering, gasoline torch or gas and compressed air are used. The metallic arc has been tried many times but causes too great a loss of zinc in the base metal. The carbon arc is only slightly more successful. Resistance spot welding and resistance seam welding can be used to good advantage but must use redesigned machines. Any good commercial brazing flux will work satisfactorily on the extruded alloys. In general, it should cling to the hot metal until it melts, spread evenly, then flake off as it cools.

Major factors in the design of projection welders are included in the paper "Modern Spot and Relief or Projection Welders and Their Application to Production Problems," by P. W. Fassler, consulting engineer of Detroit. Major factors include: area of embossments; number of embossments to be welded in one operation; thickness or height of embossments; thickness and area of metal pieces under the electrode to be welded together; grade of steel; gram calories of heat required to make the weld; time required to make the weld; pressure per embossment during current application; final pressure after current is turned off; welding voltage; kva. demand on the transformer; necessity of bringing the surface of the welded pieces in intimate contact. Gram calories required for a given weld are practically constant if the welding time is not too long. Radiation and conduction introduce heat losses which are greater as the welding time is increased; the kva. demand is greater for a welding time of short duration than for one of longer duration; welding voltage must be increased as the welding time is decreased. This is not a straight line function. A good empirical rule is to increase welding voltage about 15 per cent for a 40 per cent increase in welding time. Welding voltage must be increased as more embossments are added to compensate for the voltage drop in the secondary circuit; kilowatts, kilowatt seconds and welding voltage are all affected when it is necessary to bring the welding stock in intimate contact. Welding voltage, welding current and kva. increase as the pressure per embossment during application is increased. In the accompanying Table II is shown the embossment characteristics in relation to the thickness of the welding stock.

J. L. Anderson, of Air Reduction Company, discussed "Machine Gas Welding" and described the progress to date and the types of applications where machine gas welding is used. In answer to a question during discussion, Mr. Anderson explained that speeds about twenty times those obtainable by hand are obtained by machine gas welding on thicknesses of metal up to $\frac{3}{16}$ in. In lighter gages, 16 for example, speeds up to 20 or more ft. per min. have been attained, in 14 gage, speeds from 26 to 30 ft. per min. and 10 gage, 36 ft. per min. with some supplementary heating. Without preheat the speed runs about 10 ft. per min. Principal uses thus far of machine gas welding have been in the automotive industry.

Ambridge Test of Paints for Water Tanks

PITTSBURGH Des Moines Steel Co. and the Borough of Ambridge, Pa., who are jointly conducting an extensive test of paints for the interiors of water tanks, have announced the results of the seventh inspection of the 196 paint panels made April 15, after 186 days' exposure. The average ratings on April 15, 1932, for the various groups of paints into which the panels have been classified expressed in per cent of their original condition were:

Classification	Average Rating for Class
Hot Bituminous Coatings	90.3 Per Cent
Red Lead & Linseed Oil Paints	84.8 "
Asphalt Emulsions (Plain)	82.5 "
Aluminum Paints	81.9 "
Thick Plastic Coatings	80.1 "
Elaterite Coatings	79.7 "
Coal Tar Paints	73.9 "
Asphalt Emulsion & Filler	69.7 "
Clear Varnish Finishes	68.1 "
Synthetic Gum Vehicle	64.1 "
Misc. Cold Bituminous Paints	61.6 "
Other Linseed Oil Paints	56.0 "
Gilsonite Asphalt Paints	44.7 "
Pyroxolin Base Paints	38.5 "

Considerable cold weather occurred during the period covered by this report, causing the formation of a layer of ice approximately 6 in. thick which damaged many of the panels, especially the hot bituminous coatings.

A preliminary report of the above test containing detail information as to the manufacturers' names, kinds of paint, price per gallon, spreading rate and approximate cost per 1,000 sq.ft. of the paints having the best ratings will be published by Pittsburgh Des Moines Steel Co. and copies may be obtained upon request, addressing Pittsburgh Des Moines Steel Co., 3408 Grand Ave., Neville Island P. O., Pittsburgh, Pa.

The eighth inspection after 217 days' exposure will be held May 16, 1932. Previous results appeared in *AM*—Vol. 75, page 895 and Vol. 76, pages 237 and 271.

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Selecting Suitable Diamonds

MAURICE S. DESSAU
Industrial Diamond Specialists

MAIN factors in determining the correct size or weight of an industrial diamond used for dressing various sizes of grinding wheels are diameter, thickness and hardness, or grain, of the wheel. It is poor policy to employ too small a diamond, just as it is poor to use one too large. The following table may be of assistance in determining the size of diamond necessary to use with wheels of various sizes:

Diameter of Wheel, Inches	Stone Size, Karats
6	$\frac{1}{2}$
8	$\frac{3}{4}$
12	1
14	$1\frac{1}{4}$
16 to 18	$1\frac{1}{2}$
20 to 24	2 to $2\frac{1}{2}$
30 to 36	3 to $3\frac{1}{2}$

Larger diamonds than those indicated above should be used for wide-face wheels.

IDEAS FROM PRACTICAL MEN

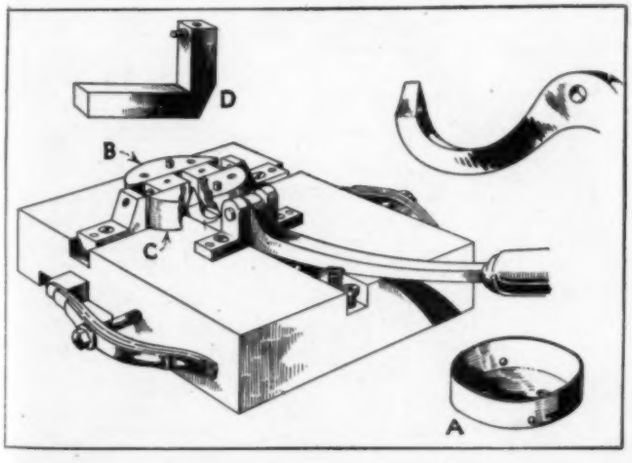
A Hand-Operated Piercing Fixture

CHARLES H. WILLEY
Superintendent of Manufacturing
Hoyt Electrical Instrument Works

LATELY we brought out line of meters, part of which required cases of the sort shown at *A*. Besides the two holes in the bottoms, two other holes were to be pierced in the sides for the wire leads. The fixture illustrated is for piercing the holes in the sides, the holes in the bottoms having been pierced in the blanking operation.

The cases are placed in the fixture over the blocks *B* and *C* and between the dies, being located by pins through the bottom holes. The punches are mounted on sliding pieces, one of which is shown at *D*, the vertical parts sliding between the blocks *B* and *C*, while the horizontal parts slide in grooves in the bottom of the fixture. The ends of the horizontal parts protrude beyond the sides of the fixture and are opposed by leaf springs.

In operation, when the operating lever is depressed, its wedge-shaped toe contacts with the angular heels of the sliding pieces and forces them outward, so that the punches pierce the holes in the sides of the cases. Slots milled in the bottoms of the blocks *B* and *C* provide clearance for the toe end of the operating lever as it swings in its circular path. A stop under the operating lever limits the outward movement of the sliding pieces and the punches mounted thereon. The tool is simple and possesses features that can be adapted to tools for a lot of different punching operations.

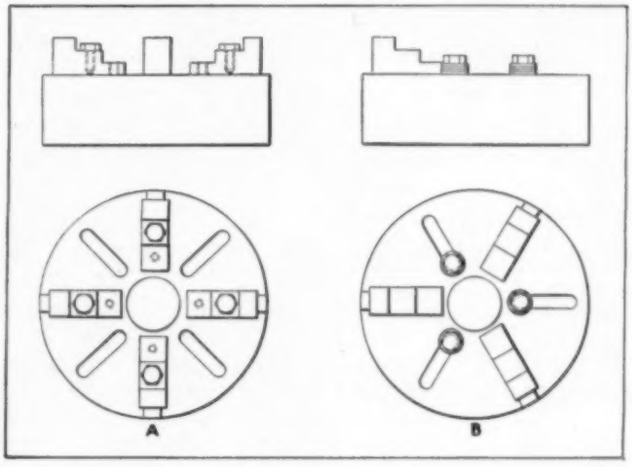


Holding Thin Work in the Lathe Chuck
Discussion

T. GRANFIELD
Coventry, England

I have been much interested in the discussions that have raged around R. H. Kiddle's descriptions as to how he deals with the turning of a thin ring as an odd job (*AM*—Vols. 74 and 75, pages 183 and 390, respectively). I think his method is quite good for odd jobs.

Lately we have had to machine one or two rings of rather large diameter, 18 to 24 in., and fortunately the machine to which they were allotted was fitted with a chuck in which the jaws were drilled, and tapped by the makers. So all we had to do was to put in some screws with washers under their heads and to skim off the heads of the screws to the required height. I would say that the chuck was in good condition with next to no play in the jaws, consequently, we got a good job in this way.



In the illustration, the chuck with the screws in position may be seen at *A*. For smaller work where the chuck jaws are not drilled and tapped, we use the method shown at *B*. Here, bolts and washers are held in the slots in the chuck body, and when their correct radial position has been found, the bolts are tightened and their heads are skimmed off in position. This method also has given good results. For small batches, soft jaws can be obtained for certain makes of chucks, and they will enable a good job to be turned out. Of course, it would not pay to buy soft jaws for machining one piece, but they are handy in a shop where odd jobs crop up.

A Jig for Drilling Pins—*Discussion*

HARRY SHAW
Consulting Engineer, Heywood, Lancashire, England

There are several points about the jig described by Robert S. Alexander in an article under the title given above (*AM*—Vol. 75, page 572) that warrant criticism. The small hole *A* in Fig. 1 of the accompanying illustration will gradually become filled with cuttings that will tend to dull the drill and obstruct the removal of the

pins. A hole at *B*, or a hole through the shank of the jig, depending upon which is most convenient, would allow the cuttings to come away.

The drilling of the small cross holes will raise burrs on the pins, and these burrs will prevent the work from being removed easily. They will also score or groove the holes in which the pins fit, and this scoring of the holes will probably ultimately mark the pins. Grooves *C* on the sides of the holes will prevent the burrs from scoring the holes. The trouble experienced with burrs preventing the removal of work is one great bugbear with poorly designed jigs, often cutting down the output by half or more, because of the extra time spent by the workmen in removing the work. The pins seem rather awkward to grip for removal, making the provision of ejectors, as at *D*, advisable. Every endeavor should be made to reduce the length of the drills used, and the arrangement shown in Fig. 2 is suggested as a means for accomplishing it. In any case the metal at *E* (Fig. 1) should be removed to the dotted line. Pins such as those shown by Mr. Alexander, usually require the cross holes to be located a certain distance from the under sides of the heads, and not from the ends of the pins. Many methods of accomplishing this are possible. A plate with holes for the shanks of the pins to pass through, fixed to the jig, could be used to locate the pins by their heads, different distances of the cross holes from the heads being accommodated by washers under the locating plate.

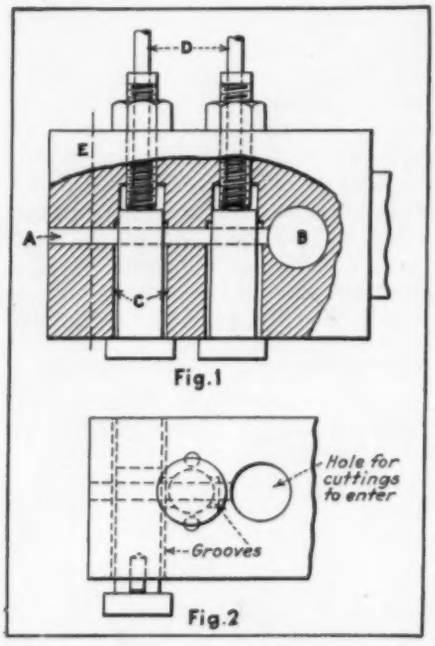


Fig. 1

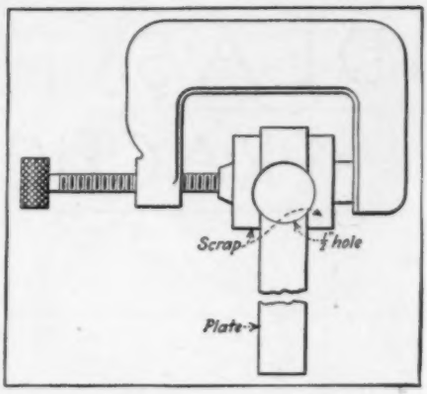
Fig. 2

If there is sufficient room, as there would be if the arrangement shown in Fig. 2 were used, the pins could be located by threaded and locked bushings, the shanks passing through the bushings and the bushings being screwed in or out to give the required distance between the heads and the cross holes. Another way would be to insert one or two loosely driven pins to locate the cross holes from their heads. This is shown in Fig. 2 and is perhaps the simplest method.

A Small-Shop Kink—*Discussion*

CHARLES KUGLER

At the end of the article under the title given above (*AM*—Vol. 75, page 898), Charles H. Willey says, "Perhaps there is no easier way to do this job in a shop equipped only with light tools." In my opinion there are several easier ways of doing the job under the same conditions; that is with the same tools. In the first place, the plates could have been cut off by drilling, not a series of holes, but just two holes 7½ in. long, drilling from both ends of the plates so that the holes would meet in the center. I would use a ½-in. drill and would clamp two pieces of scrap metal to each plate, as indicated in the sketch, to prevent the drill from running off. If the ½-in. drills in stock are not long enough, it is not a difficult matter to make an extension for them.



If the work is to be done by milling, instead of using a slitting saw, a side-milling cutter should have been used. The teeth on the sides would have prevented it from digging in. In doing the work in the shaper, if a spring cutting-off tool is used it would not dig in.

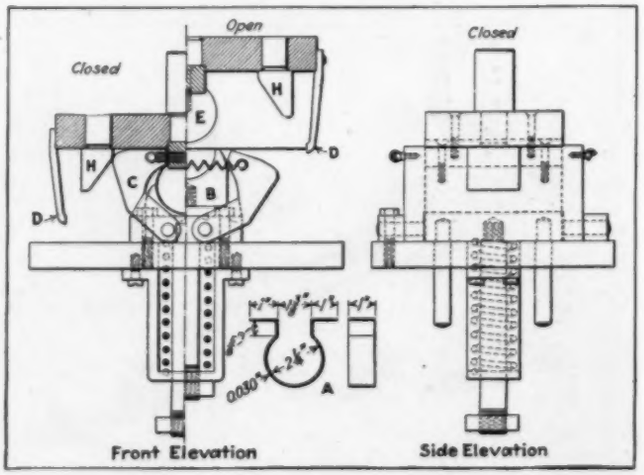
Summing up the different methods of doing the job, on first though it would seem that milling would be the best. However, since there was no way of supporting the outboard end of the arbor, it appears to me that cutting off the plates in the shaper, using a spring cutting-off tool would be better under the circumstances. I am sure that a plate could be cut off by this method in 15 min. However, if there were no side-milling cutter or spring cutting-off tool available, I would do the work by drilling, as outlined above.

Forming Tools for a Power Press

CARL G. ALT

The press tools illustrated are for forming brackets, such as the one shown at *A*, from 0.030x1-in. soft cold-rolled steel. The die *B* is held up by a heavy spring, keeping the links *C* in the open position. In placing the stock, it is located by the guide stops *D* attached to the punch-holder.

In operation, as the ram descends, the forming punch *E* forces the blank into the circular opening in the die. This motion carries the die down against the pressure of the spring, thus releasing the links *C*, which are brought against the work by pull springs at the back and



front. During the down stroke, the stationary cams *H* contact with the links and close them upon the work, completing the circular bend and forming the straight neck. At the end of the down stroke, the flat part of the upper member bends the wings to a right angle on each side of the neck and flattens them on top of the links.

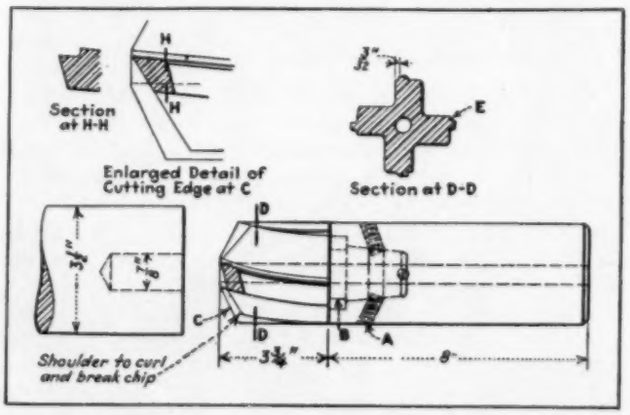
The finished brackets remain on the forming punch, and when the ram stops at the top of its stroke they are stripped from the punch by sliding them off by hand. The tools are deep enough from front to back to hold five blanks in tandem, thus five brackets are formed in each cycle.

A Chip-Breaking Drill

HERBERT M. DARLING
Engineer, Wells Manufacturing Company

A bearing manufacturer was making a large quantity of high-carbon alloy-steel rings from 3½-in. diameter bar stock in an automatic screw machine. The first operation was to drill a starting hole ⅞ in. in diameter and 1⅛ in. deep. This was followed by a 2¼-in. twist drill, which caused a lot of grief. A regular high-speed drill costing about $25 was used. As this drill was too long, about seven inches had to be cut off of it, adding another expense and taking away the best part of the drill. In use, the drill would turn out long, tough chips, causing the operator a lot of trouble and keeping the chip man busy.

To overcome the difficulties, the tool shown in the accompanying sketch was made. The straight shank was made of chrome-nickel steel (S.A.E. 3250), heat-treated, hardened, and ground. The cutter was made from high-speed steel and fitted to the shank, being held by the two screws *A* and driven by the flatted portion *B*. A ¼-in. oil hole passed through the shank and the cutter. A drift-pin hole providing for the removal of the cutter, was closed by two headless screws to prevent the loss of oil.

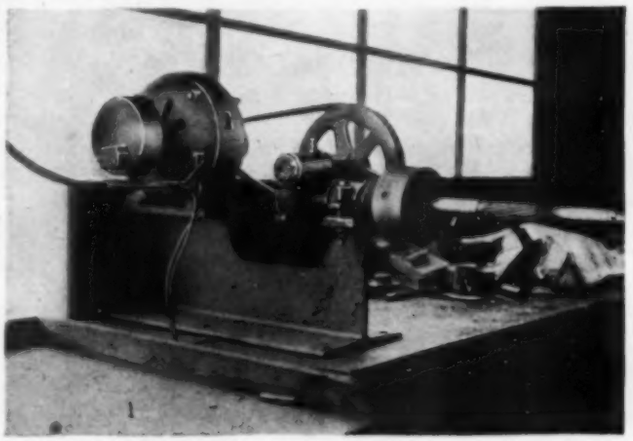


The cutter was made as a four-fluted drill, having a chip-breaking shoulder just back of the cutting edge *C*, which curled the chips and broke them into short pieces. This pleased both the operator and the chip man. To act as a guide in grinding the chip-breaking shoulder, the lands were fluted as shown in section *D-D*. After grinding the cutting edges *C*, the chip-breaker shoulder was ground back, free hand, using the edge *E* as a guide. This tool not only ended the chip troubles, but its cost was but $16.50 and it lasted longer per grind that did the drill, as the oil was delivered to the cutting point and gave better cooling and lubrication.

Compact Piston Reaming Machine

HERBERT F. CRAWFORD

Reaming pistons is a common operation in repairing internal combustion motors of all kinds, and some method of driving the reamer is always much more satisfactory than attempting to do it by hand. The machine shown was built with a section of I-beam as a



base and is compact and substantial. The lower flange forms the base and the upper flange supports the motor and the spindle. The section cut out between gives space for the worm drive between the motor and the spindle. This worm drive is part of the steering gear from a Chrevolet car.

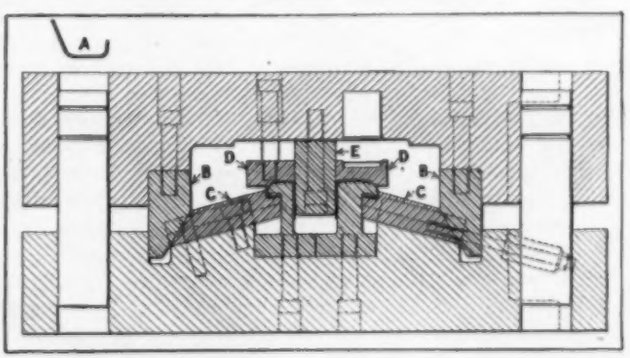
The spindle bearing is self-contained and bolted to the upper flange of the I-beam and also carries the worm gear with its shaft and pulley. The quarter horsepower motor gives ample power and the machine weighs enough to hold it steady without fastening. This was built by W. E. Roake, Glendale, Calif., for use in his own shop.

Press Tools for Windshield Moldings

C. F. STAPLES

The press tools illustrated are for finish forming the right- and left-hand moldings for automobile windshields, after blanking and making the preliminary bend shown at *A*, and piercing the necessary holes. The moldings are slightly tapered endwise to facilitate stripping, the taper being indicated by the difference in thickness of the die sections. One section is shown near the front, while the other is near the back.

The cam blocks *B* operate the forming slides *C*, the



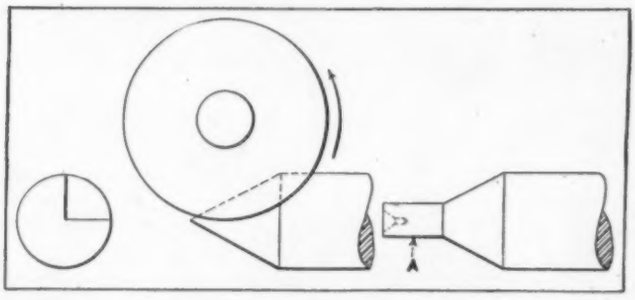
slides being set on an angle to bend the lower parts of the outer flanges through an arc of 105 deg., as shown. In operation, two blanks are laid on top of the die, one at the right and the other at the left. As the ram descends, both blanks are held by the pressure pads *D*. As the ram continues its descent, the punch *E* makes the final form on the inner or long flanges, while the outer or short flanges are formed by the forming slides *C*, operated by the cam blocks. As the ram ascends, the cam blocks are drawn upward and the forming slides are returned to their normal positions by springs (not shown), after which the work is stripped by hand.

A Three-Quarter Center for the Tailstock
Discussion

CHARLES F. KRAUT

In an article under the title given above (*AM*—Vol. 76, page 145), Arthur Silvester says, "——many concerns have discarded the three-quarter centers because they cracked in the sharp corners in hardening, rendering them useless."

If the center is turned so as to leave a teat on the end, as at *A*, there will be no sharp point to contract rapidly



in quenching, with the consequent danger of cracking. After hardening, the teat can be ground off in the process of pointing. The groove can be ground by using a small wheel, as indicated in the illustration. Care should, of course, be taken not to grind rapidly enough to heat and soften the point.

SEEN AND HEARD

JOHN R. GODFREY

Specs and Rolling Chairs

When seams in metal airplane propellers are being gas-welded, any pause produces a flaw that may eventually mean a fracture. It is essential that the seam, once started, be continued to the end. To insure such continuance, one welding company has equipped its foremen with "Sportoculars," or spectacle-type binoculars, in order that they may watch from any point in the shop to be certain that no welder has stopped a seam. Another source of pauses was the necessity for the operator to "hitch" his chair along as the seam progressed. Difficulties in this direction have been avoided by putting casters on the chairs.

Maintaining Grinding Wheel Contour

One tool builder has reverted to the first principle used in gear grinding, using a contour wheel grinding adjacent faces of two teeth. A new wrinkle, however, is an automatic tool-head swinging arrangement that moves the wheel, after four passes, between two cam-operated diamond dressers to renew the contour.

Motor-Driven Pumps 6,000 Feet Below Ground

Oil well people have some peculiar problems and solve them in their own way. One of the latest is to build a multi-stage turbine pump and motor into a pipe and drop the whole thing down the well into the ground, with wires running down from the power lines above. Then, instead of the mile-long and more pump rods that are often way out of plumb when the oil drill "runs," the current from above runs the motor-driven pump and forces the oil up to the surface. And if you don't think that is some head to force against just figure it up at 27 in. to the pound!

An Endless Leather Belt

The making of a small round belt without the troublesome fastener joining the ends together is often desirable but difficult to do. Such a belt was found in one plant driving a small grinding wheel used in internal angular grinding. The belt, about eight inches in length, was cut from a piece of old leather belting 1¼ in. wide and of course in an endless piece rectangular in shape. The strip is then soaked in oil and the corners pounded with a hammer to flatten them out. A vise die is next used with three or four positions through which the belt is pulled successively to reduce it to the desired diameter. The belt is then placed on a stretcher to bring it to the desired length.

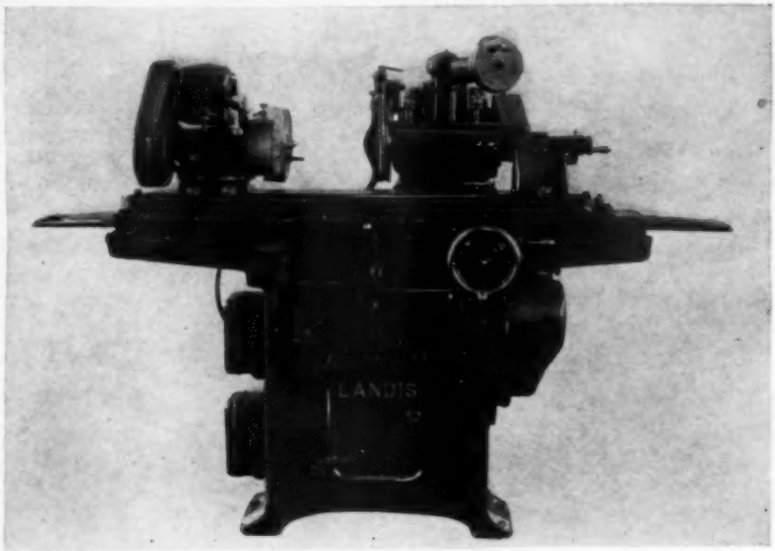
Preventing Corrosion in Duralumin

Intercrystalline corrosion of duralumin-type aluminum alloys has been a bugaboo for some time, and is especially important in airplane structures where failure in service would lead to disastrous results. Studies of this problem made for the British Air Ministry were discussed in a paper delivered at the annual meeting of the Institute of Metals in London. They showed that this form of corrosion is increased in aluminum alloy parts that have been over-strained in fabricating. In the heat-treatment it was demonstrated that quenching at higher temperatures reduced the danger from intercrystalline corrosion, and that this corrosion is also reduced if the parts are quenched in cold water instead of in hot water.

Lubricating a Punch

Swabbing a punch to lubricate it before it goes through the plate has its drawbacks. It takes time and is mussy, to put it mildly. One shop drills a small hole through the center of the punch and forces a few drops of oil through the hole. When the punch strikes the plate the oil spreads all over the face of the punch and lubricates the plate as it goes through. This method is used in punching alloy steel plates and works out well.

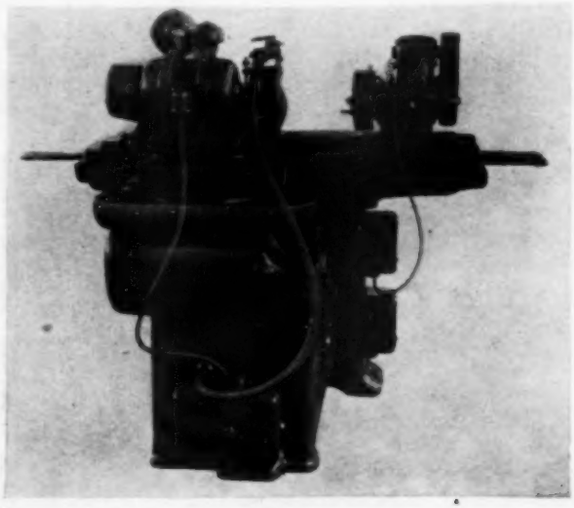
SHOP EQUIPMENT NEWS



Landis 10x24-In. Motor-Driven Universal Grinding Machine

THIS 10 x 24-in. motor-driven universal grinding machine is designed for grinding a variety of light parts manufactured in small lots, for tool rooms and for technical colleges and schools. It is being manufactured by Landis Tool Co., Waynesboro, Pa.

Controls are conveniently grouped. The traverse drive motor is mounted within the bed where it is protected from grit and water, the work drive motor is on the headstock, while the wheel drive motor is mounted on the wheelbase. A water reservoir is also integral with the bed, thus making the machine entirely motorized and self-contained. Control of all three motors is from the front.



The work carriage traverses on a V and a flat guide with chilled surfaces. Covers are provided at both ends for the guides. Drive from the traverse motor is by means of a flat leather belt through a positive clutch and a rack and pinion. A three-step cone pulley arrangement, accessible at the side, makes provision for three traversing speeds. A lever at the front is provided to disengage the clutch when it is desired to traverse the carriage by hand.

The grinding wheelhead is supported by a slide having a V and a flat guide with chilled surfaces. Steel-back babbitt wheel spindle bearings are used. The chrome-vanadium steel grinding wheel spindle is driven from the right-hand end through a flat belt from the motor on top of the wheelbase casting. The wheelhead may be swiveled on its slide, thus permitting the wheel to be set at various angles without influencing the direction of the feeding movement. These units are also mounted on a lower swivel which can be turned to feed the wheel in different directions. A plain wheel feed mechanism is used.

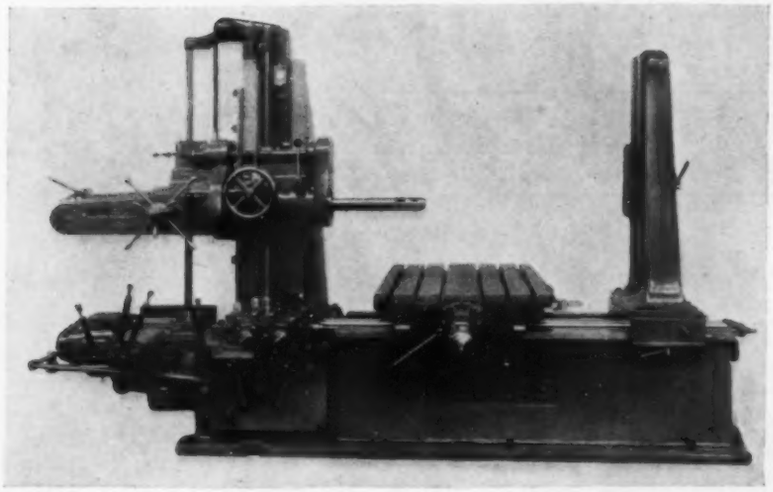
The headstock drive motor is mounted on a hinged plate, changeable to maintain proper belt tension. Six work speeds are available. A lever at the front of the head may be depressed to keep the work from drifting after the motor has been stopped. The spindle may be rotated for live-spindle grinding or locked for dead-spindle grinding. It is also possible to swivel the upper portion of the head a full 90 deg. for face grinding.

The water pump is attached to a bracket inside of the bed, and is driven through a flat belt by the worktable traverse motor. A ball-bearing type internal fixture is supplied. It is rigidly mounted on the front of the wheelhead, being driven by a flexible canvas belt from a pulley attached to the regular wheel spindle driving pulley on the motor. A hand reversing switch reverses the direction of the motor rotation for internal grinding.

Net weight of the machine, without electrical equipment, is 3,050 lb. A $\frac{1}{6}$-hp. work drive motor, a $\frac{1}{2}$-hp. traverse drive motor and a 1-hp. grinding wheel drive motor along with their starting equipment, are all attached to the machine before shipment. Standard equipment includes a 10x$\frac{1}{2}$x5-in. grinding wheel.

Auxiliary "Hi-Speed" Drive for Lucas "Precision" Horizontal Boring Machines

Extension of the utility of the Lucas "Precision" horizontal boring, drilling and milling machine is provided by recent development of an



Auxiliary Hi-Speed Drive on No. 41 Lucas "Precision" Horizontal Boring Machine

auxiliary high-speed drive to the main spindle which is now being applied to the boring machines manufactured by Lucas Machine Tool Co., E. 99th St. & N.Y.C.R.R., Cleveland, Ohio. Final drive at the high-speed range is by means of multiple V-belts of ample capacity, involving no excessive peripheral speed of toothed gearing, otherwise unavoidable because of the limitation imposed by the large diameter of the spindle sleeve on which a gear must be mounted. The high-speed drive cannot be engaged until the large spur gears providing slow-speed drive for the spindle are shifted out of mesh by an interlocking lever.

This unit adds six spindle speeds to the small size No. 41 and seven speeds for the larger size machines, over and above the regular range of 18 geared speeds. Range of the 3-in. spindle No. 41 machine is 13½ to 1,200 r.p.m., of the 4-in. spindle No. 42 machine 9 to 1,000 r.p.m., and of the 5-in. spindle No. 43 and No. 53 machines 7½ to 860 r.p.m. These speeds are claimed to cover the range from a ¼-in. drill running 80 ft. per min. to boring or facing diameters up to 30 in. at 60 ft. per min. in cast iron. Cutting speeds up to 300 ft. per min. with tungsten-carbide cutters on cast iron, or 800 to 1,000 ft. per min. on aluminum are obtainable, even with comparatively small end mills.

The entire drive, including the spindle, is carried in anti-friction bearings to permit high rotative speeds and close adjustment.

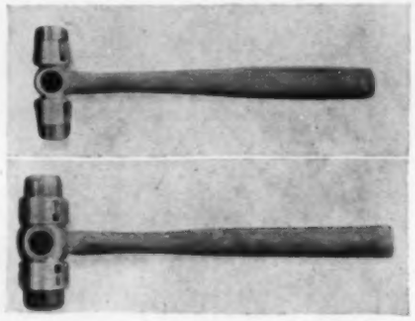
Availability of a full range of speeds in a single, large spindle is an advantage in such jobs as milling with the spindle extended a considerable distance. The stiffness of the main spindle and the large taper shank it will take are particularly desirable. Using the same spindle for all tools makes possible the boring and drilling of both large and small holes at both extremes of the vertical range of the machine with a single positioning, thus avoiding complication in indexing for correct center distances between large and small bores.

Ransohoff Quenching Tank

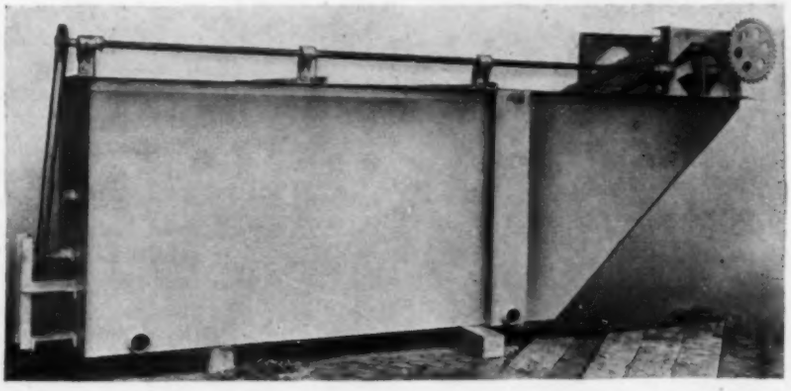
A new type of automatic quenching tank being manufactured by N. Ransohoff, Inc., Cincinnati, Ohio, is installed in a pit in the floor. Heat-treated work slides down a grating from the furnaces onto an open mesh conveyor into the tank. It travels through the tank slowly and is discharged into a container at the end. A propeller wheel which keeps the water in circulation is operated by the small round belt seen at the left. The tank is equipped with baffle plates so that the cooling compound is kept in constant circulation in order to speed quenching. The first application of the tank has been in a motor-car plant.

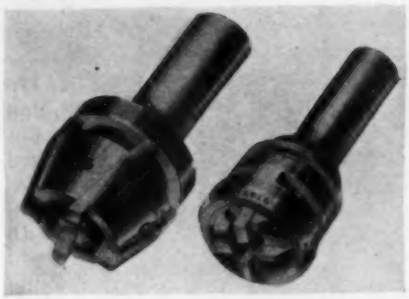
"Red-Spot" Double Copper and Rawhide Faced Hammers

Double-faced copper and rawhide hammers and a universal hammer with one steel face and the other of softer material are being manufactured by Lapeer Engineering & Mfg. Co., Lapeer, Mich. The universal style is claimed to be two complete hammers on one handle, a hard face with rounded edge for general hammering and riveting and a soft face for hammering finished work. Soft faces can be furnished in annealed copper, bronze, brass, aluminum, babbitt, rawhide, fiber or wood. The faces are designed so that they grip more tightly as used and still may be replaced easily. Wood, fiber or rawhide faces are attached by wood screws, while copper, brass or aluminum faces fit into a wedge-shaped recess into which they expand when hammered upon. Slots are provided so that they may be removed easily.



Double-faced hammers are similarly designed, except that both faces are of soft material. The double-faced rawhide hammer uses rawhide inserts with a self-tightening aluminum base, the rawhide insert being milled and fitted to the plate with a recess on the bottom so that it locks into the hammer when pressed in place. The hammers are available in various weights from 6 oz. to 12 lb.





Gairing Types H and J Hollow Mills

Two types of adjustable blade hollow mills, Type H for heavy production and the Type J for light roughing and finishing cuts, are being introduced by Gairing Tool Co., Detroit, Mich. The adjustments on the Type H are made by rotating the cone-shaped external nut, which has direct bearing on the outer edge of the blade. A micrometer dial on the adjusting nut is graduated in thousandths to give any required diameter, thus speeding resetting. The interchangeable blades have a positive lock secured in the body, and are of such construction that tilting is impossible. They may be of high-speed steel, Stellite, or cemented tungsten carbide, the first being standard. The same mill may be used for straight or taper surfaces and facing operations. Blade adjustment is $\frac{1}{4}$ in. Additional adjustment to $\frac{3}{8}$ in. can be made when the mill is used for medium or finish cuts. When the hollow mill is used for finishing, blades may be adjusted outwardly from the body.

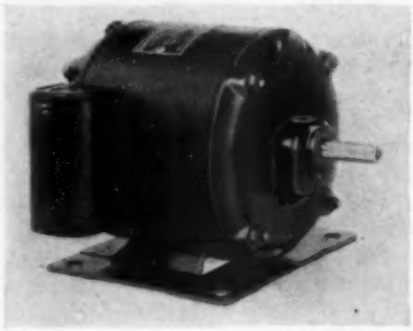
Bodies are of alloy steel, heat-treated, and are available either made for multiple cuts or equipped with drills and reamers. Pilots can be inserted for facing and spotfacing operations.

The Type J mill may be fitted with drills, reamers or form blades. Blades are set radially for machining brass, bronze, cast iron, etc., and are set at an angle for cutting steel. Serrated blades are used, anchored in position by engaging a corresponding serration in the body. A hardened and ground steel wedge, supporting the blade the entire length of the body, holds it rigid. Quick adjustment for release or replacement of blades is obtained by releasing the lock screw holding the wedge. Adjustment is both radial and lateral. A locking or thrust collar on the threaded portion of the body urges the cutting blades forward in their slots. Each blade has a minimum of $\frac{1}{2}$-in. blade life. An adjustment of $\frac{1}{8}$ in. can be obtained by the adjusting nut.

Special hollow mills are also available.

Wagner Split-Phase Motors, Types 44RB and 56RB

Two split-phase motors, the 44RB and the 56RB, have been announced by Wagner Electric Corp., 6444 Plymouth Ave., St. Louis, Mo. Both have been completely redesigned, according to the manufacturer, for



quiet, vibrationless, and cool operation. New features include: Dip-proof endplates, wool-yarn lubrication, handy conduit box adjustable in four positions, and a redesigned switching mechanism on the 44RB. The 44RB is available in $\frac{1}{30}$ and $\frac{1}{20}$ hp., and the 56RB in $\frac{1}{8}$, $\frac{1}{6}$, and $\frac{1}{4}$ hp., 1,725 and 1,140 r.p.m., all cycles.

Ton Wate Swivel Caster

Elimination of the king-bolt and its replacement by a flexible unit features the Ton Wate swivel truck caster, introduced by Divine Bros. Co., Utica, N. Y. It is of simplified 2-piece design, constructed through-

out of heat-treated steel forgings, with chrome-nickel steel balls and Hyatt roller bearings. A flexible ball joint replaces the rigid king pin and is seated on the hardened cup of a Dardelet self-locking safety setscrew. The raceways are held together by the simple method of splitting them vertically, instead of horizontally. The load is claimed to be distributed through this balanced assembly on center and annular balls, approximately two-thirds on the former and one-third on the latter. The axle rides on Hyatt automotive type rolled bearings in a Hyatt split outer race.

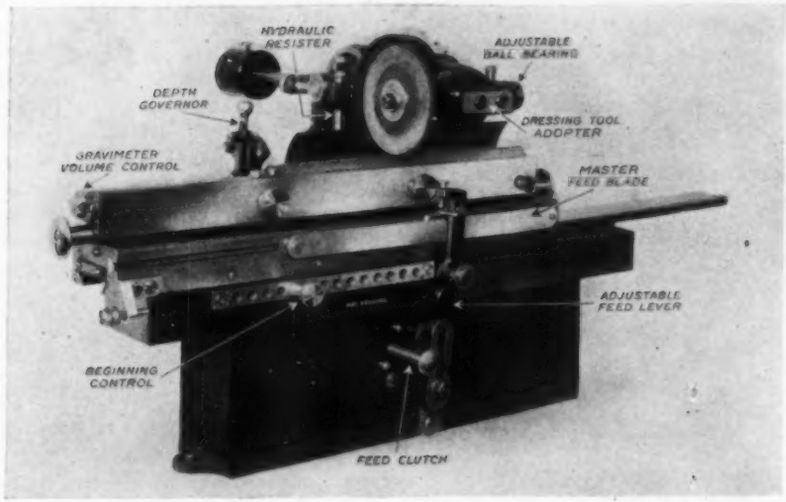
Main load bearing and swivel bearings operate in a continuous reservoir of lubricant, properly sealed. The axle also is protected by positive lubrication. Hub guards prevent entrance of dirt or grit. It is available in a wide range of sizes, with steel and canvas cushion wheels.

"Nicral" Aluminum Alloys

Aluminum alloys containing nickel and chromium and known as "Nicral," are now being marketed by Nicralumin Co., 146 W. Cortland St., Jackson, Mich. They were until recently marketed by Sheet Aluminum Corp., same city. In this system of alloys the Brinell hardness varies from 40 to 120, depending upon grade and temper, and almost any demand of hardness and strength can be met. Approximate composition of the alloys is:

NICRAL	B	A	X
Ni	0.5	.1	1.0 per cent
Cr and related metals	0.25	.5	0.5 per cent
Cu	0.25	.5	1.0
Mg	0.25	.5	0.5
Fe & Si as in commercially pure aluminum			
Al	Remainder		

The color of Nicral resembles chromium plate, and this holds especially true for Nicral A. Nicral B is not far removed from pure aluminum in regard to color. All grades maintain a polished surface without excessive tarnishing. Alloys are suitable for drawing and forming, have good resistance to fatigue, are weldable, have high coefficients of reflectivity, retain strength at elevated temperatures, and cast well. They are not subject to spontaneous aging. Weight per cu. in. is approximately 1 lb., and Youngs' modulus of elasticity is slightly in excess of 10,000,000.



"Elenel" Reclaiming Machine for Machine Hacksaw Blades

High-speed steel machine hacksaw blades are claimed to be reclaimable at a cost of 10 per cent of that of new blades by resharpening in an automatic machine developed by L. & L. Mfg. Co., 54-58 Springdale Ave., East Orange, N. J. The company also claims various advantages for the manner in which the teeth are ground, including that teeth are ground at a true right angle with the line of cutting of the blade and that therefore the operation eliminates any "negative rake" obtained when teeth are set. Ordinarily blades may be resharpened three times.

In this machine a grinding wheel is mounted on a frame which swings alternately up and down under cam control, the machine indexing during upward movement of the wheel. Indexing of the teeth is accomplished through an adjustable cam-actuated mechanism at the front, including a pawl that engages a master hacksaw blade mounted on the front of the table to which the workholder is attached. A plug is adjustable in various tapped holes in a bar on the front of the base for positioning to suit different lengths of blade. In starting the operation, the carriage is pushed to the right until the adjustable stop screw at the left-hand end strikes the plug.

Each operation is begun by pulling out the knob on the front of the machine to engage a feed clutch. When the cut is completed, the carriage may be re-indexed by lifting the pawl engaging the indexing mechanism. A narrow adjustable slot in the holder permits the blade being ground to float slightly longitudinally and vertically. Thus the blade positions itself relative to the wheel when the wheel comes in contact and any inaccuracies in blades are easily compensated for. Should a tooth be missing in the blade, the holder will continue to index and position the blade correctly for the next tooth. A rest supports the blade along its bottom edge until the downward pressure of the grinding wheel overcomes the weight action and presses the blade downward. This permits much longer contact between grinding wheel and tooth than if the blade were stationary. Therefore blades can be resharpened in a minimum number of passes.

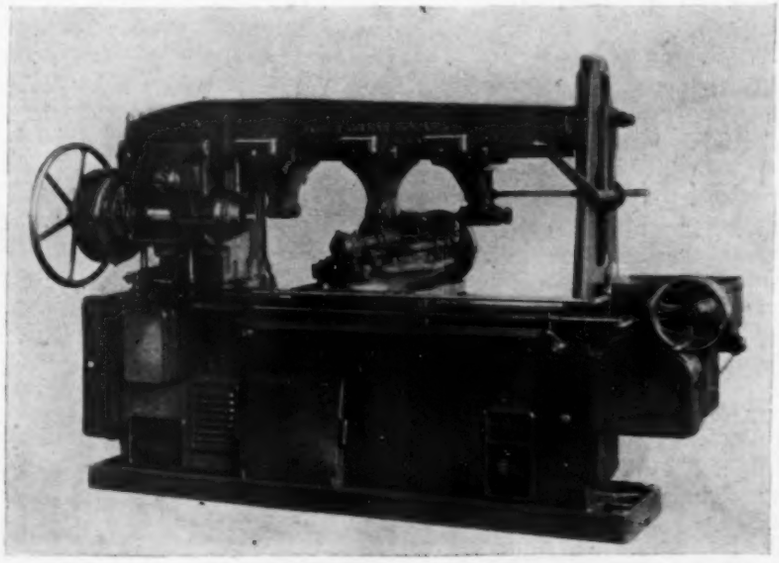
Downward movement of the grinding wheel is retired by a hydraulic device which is adjustable in large or small amounts to meet conditions. Up and down movements of the grinding wheel are always the same length, but the position of the stroke is changed to suit different widths of blades. The manufacturer claims that several dozen blades can be sharpened with one truing of the wheel. A diamond holder can be applied to the grinding wheel frame for dressing. The wheel is dished on one side and ground on the edge to the proper angle.

The machine is designed for use on a bench. It is 28 in. long, 15 in. wide, 17 in. high, and weighs 240 lb. A $\frac{1}{16}$-hp. repulsion-induction motor is supplied for drive. Blades up to 21 in. long from $\frac{5}{8}$ to $1\frac{1}{2}$ in. wide, of any thickness and with any tooth pitch can be reclaimed.

Barber-Colman Spline Shaft Hobbing Machine

The Barber-Colman Co., Rockford, Ill., is offering a hobbing machine especially suited for cutting long spline shafts. The standard Type A machine recently announced (Vol. 75, p.715) has been modified for this work by lengthening the bed. Other parts of the machine, such as the feed screw, the automatic stop rods and bars and the power shaft for the feed box, together with the overhanging arm, are also lengthened accordingly. The outer end of the overhanging arm is raised and lowered by a screw driven from the work spindle elevating mechanism, thus insuring that alignment of the arm with the bedways will be maintained. All other parts of the long bed model are the same as in the standard Type A machine.

The illustration shows the type of special tooling that is generally sup-

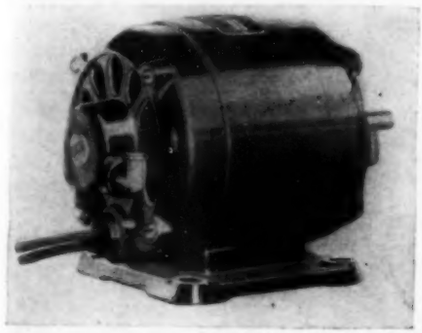


plied for spline shaft work. The work spindle has a collet-type nose with a large handwheel for clamping the work firmly in the collet. Two work supports are mounted on the overhanging arm, these consisting of half sleeves in which the work revolves and which are intended to prevent long shafts from springing out of line during the cut.

Standard features of the Type A hobbing machine are preserved, such as longitudinal movement of the slide accomplished by a feed screw fitted with an automatic "stabilizer" arranged to give a steady frictional drag so that the hob will not jump. Timken roller bearings carry the hob spindle which is mounted in a slide that swivels 50 deg. either side of zero. The work spindle runs in bronze bearings and its slide carries the index worm and worm gear mechanism. Eight speeds are available.

Bodine Type N-3 Motor

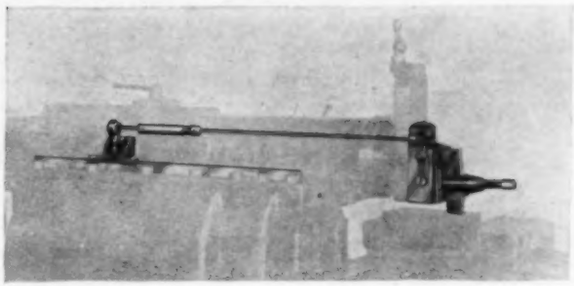
A small motor with wool-packed bearings has been announced by Bodine Electric Co., 2264 W. Ohio St., Chicago, Ill. This motor, designated as Type N-3, is similar to Type N-5 but is rated at $\frac{1}{30}$ and $\frac{1}{15}$ hp. at 1,725 and 3,400 r.p.m., and at



$\frac{1}{10}$ and $\frac{1}{6}$ hp., at 1,125 r.p.m. Synchronous and split-phase induction motors and series and shunt d.c. motors are available in the same frame. A simplified automatic cut-out is incorporated. Large ventilating ducts are provided. This motor meets N.E.M.A. standards for long-hour duty.

Gould & Eberhardt Shaper Tool Lifter

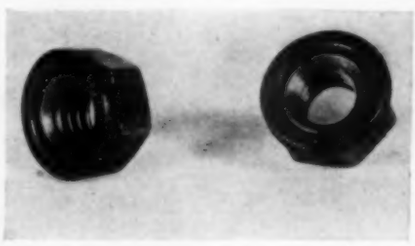
Difficulties have been encountered with the drag of shaper tools on the return stroke, but they did not become acute until the development of cemented-carbide tipped tools. Carbide tools are, however, likely to chip if allowed to drag over the work. Gould & Eberhardt, Newark (Irvington), N. J., has therefore developed a device for lifting the tool on return, applicable to the company's line of shapers, including those now in service.



The device is composed of an actuating rod and a lever at the side of the clapper box. A compensating arrangement takes care of vertical and angular movement of the tool slide or offset of the clapper box. The lifter can be disconnected when not required simply by pulling a plunger in the actuating lever. The device is arranged so that the operator may lift the tool and box independently of the lifter when desired.

Bracketite Combination Lock Washers and Nuts

Assembly of capscrew and lock washer or nut and lock washer, claimed to reduce cost, simplify production, and eliminate possibility of capscrews and nuts getting into products without protective lock washers, is embodied in the Bracketite combination lock washer and nuts now being manufactured by National Machine Products Co., 4850 Bellevue Ave., Detroit, Mich. As shown, the lock washer is fastened ower a shoulder on the nut, thus enabling it to perform its usual function without being separate from the nut itself. A similar assembly is used for fastening capscrews.



"Drinox" Dry Bright-Annealing Equipment

New equipment and a new method developed by engineers of Charles F. Kenworthy, Inc., Waterbury, Conn., for bright annealing employs a neutral non-oxidizing atmosphere which envelopes the charge in a specially constructed, covered magazine during the annealing and cooling processes. The gas used is inert and non-explosive. This arrangement is claimed to overcome the principal disadvantage of the water-seal type of annealing furnace for non-ferrous metals.

The furnace developed for annealing is heavily encased in a steel shell and closed all around except for a central opening at the bottom. The furnace stands on three steel columns and has a small hydraulic ram located in the floor directly beneath the center of the furnace opening. A horizontally rotating load platform placed in an eccentric position to the heating unit has six stations which carry the loaded magazines into register with the opening in the bottom of the unit. A flexible connection supplies the non-oxidizing atmosphere.

In operation, the charge is placed in a metal container, which is then covered and the valve admitting the non-oxidizing atmosphere is opened. The magazine is then swung in position directly under the central opening in the furnace and is raised into the furnace by the hydraulic lift. At the end of the annealing period, the magazine is lowered to near the floor level, swung outward and allowed to cool. When cool, the inert gas valve is shut off, the cover removed and the annealed metals removed. Except for short intervals during the change, one magazine is in the furnace at all times, while the others are cooling or being loaded or unloaded. A pyrometer with a special multiple switch enables the operator to observe the temperature in the furnace and in any of the magazines at any time.

The furnace is built for electric or gas heating and requires neither pit nor foundation. It does not require packing and can be operated by one man with ample time to handle his own trucking. No drying room is required.

• PATENTS •

MAY 3, 1932

Metal-Working Machinery

Apparatus For Handling and Shearing Metal Strip. Carl G. Ohlson, Youngstown, Ohio, assigned to The Youngstown Sheet and Tube Co. Patent 1,856,111.

Tailstock. Moses W. H. Wilson, East Lansing, Mich., assigned to Motor Wheel Corporation. Uatent 1,856,145.

Method and Apparatus For Forming Corrugated Metal. Richards R. Bloss and Roy C. Pefeil, Columbus, Ohio, assigned to The International Derrick & Equipment Co. Patent 1,856,151.

Apparatus For Molding Helical Castings. Charles E. Nordfeldt, Walter J. Ahlquist, and Irwin M. Emery, Massillon, Ohio, assigned to The Massillon Steel Casting Co. Patent 1,856,166.

Punching Machine. Howard C. Towle, Cohasset, Mass., assigned to Bethlehem Shipbuilding Corporation. Patent 1,856,175.

Grinding Machine. Waldo J. Guild, Worcester, Mass., assigned to The Heald Machine Co. Patent 1,856,185.

Tool Slide and Actuating Mechanism Therefor. Edwin R. Smith and Albert Schinkez, Seneca Falls, N. Y., assigned to Seneca Falls Machine Co. Patent 1,856,196.

Grinding Machine. Joseph Dyson Scaife, Nottinghamshire, England, assigned to The Heald Machine Co. Patent 1,856,227.

Wheel Assembly Machine. William A. Cotes, Lansing, Mich., assigned to Reo Motor Car Co. Patent 1,856,277.

Extruding Machine. Walter Prussing, Brooklyn, N. Y., assigned to Victor Metal Products Corp. Patent 1,856,290.

Automatic Casting Machine. Albert Wood Morris, Drexel Hill, and Samuel Price Wetherill, Jr., Haverford, Pa., assigned to Wetherill-Morris Engineering Co. Patent 1,856,352.

Apparatus For Finishing Machine Parts or Elements. Frank J. Sikorovsky, Jackson, Mich. Patent 1,856,405.

Machine For Running In and Burning Crank Shaft Bearings. James G. Collins, Kalamazoo, Mich., assigned to Atlas Press Company. Patent 1,856,465.

Press For The Extrusion of Metals. Ernest Edward Judge and Francis Henry Fry, Gravesend, Kent, England, assigned to W. T. Henley's Telegraph Works Co., Ltd., London England. Patent 1,856,483.

Cutting Torch Head. Homer W. Jones, Williamsville, N. Y., assigned to The Linde Air Products Co. Patent 1,856,560.

Grinding Machine. Carson C. Gibson, Hamburg, Iowa, assigned to Two Way Electric Grinder Co. Patent 1,856,808.

Finishing Machine For Wheels, Etc. William M. Duncan, Alton, Ill. Patent 1,856,846.

Straightening and Rolling Machine. Karl Freidrich Ungerer. Pforzheim, Germany. Patent 1,856,953.

Electrical Welding Apparatus. William E. Crawford, Wauwatosa, Wisc., assigned to A. O. Smith Corp. Patent 1,857,044.

Grinding Machine. Guy Enochson, Austin, Minn. Patent 1,857,047.

Electric Welder. Fred P. McBerty, Warren, Ohio. Patent 1,857,060.

Electrical Welding Apparatus. William E. Crawford, Wauwatosa, Wis., assigned to A. O. Smith Corp. Patent 1,857,115.

Tools and Attachments

Truing Mechanism For Grinding Machines. Harvey M. Allison, Worcester, Mass., assigned to John Bath. Patent 1,856,180.

Self-Lubricating Bearing. Robert H. Whiteley, Oak Park, Ill., assigned to Robert H. Whiteley. Patent 1,856,304.

Abrasive Disk. Albert J. Doermann, Chicago, Ill., assigned to Titan Abrasives Co., Incorporated. Patent 1,856,321.

Striking Tool. Erik Gustaf Hysing, Stockholm, Sweden, assigned to Aktiebolaget Nordiska Armaturfabrikerna, Stockholm, Sweden. Patent 1,856,336.

Automatic Trip Device. Andrew Rasmussen and William S. Goodell, Racine, Wis. Patent 1,856,402.

Floating Reamer. Clayton E. Wyrick, Detroit, Mich., assigned to Gairing Tool Co. Patent 1,856,406.

Removable Chillering Jig For Pipe Welding. Andrew F. Day, Dallas, Texas, assigned to A. F. Day Construction Co. Patent 1,856,470.

Electromagnetic Clutch. Howard E. Hodgson, Wauwatosa, Wis., assigned to Cutler-Hammer, Incorporated. Patent 1,856,481.

Means For Attaching Tools To Holders. Myron D. Holcomb, Hurley, Wis. Patent 1,856,706.

Fluid-Operated Tool. Gustav C. Pearson, Denver, Colo., assigned to Gardner-Denver Co. Patent 1,856,784.

Quick Change Chuck. John Hugo Smith, Detroit, Mich. Patent 1,856,973.

Microscope-Type Measuring Machine. Malcolm K. Parkhurst, New York, N. Y., assigned to Brown & Sharpe Mfg. Co. Patent 1,857,088.

Processes

Process of Making Piston Rings. Tracy V. Buckwalter, Canton, Ohio, assigned to The Timken Roller Bearing Co. Patent 1,856,240.

Method Of Making Piston Rings. Ernest R. Hellman, Detroit, Mich. Patent 1,856,279.

Process of Melting and Deoxidizing Metals and Alloys. Wilhelm Reitmeister, Kirchmoser (Havel) Werk, Germany. Patent 1,856,293.

Pickling Tank. Charles Shriver, Massillon, Ohio. Patent 1,856,751.

Manufacture of Centrifugal Pipe Molds. Frederick C. Langenberg, Edgewater Park, N. J., assigned to United States Pipe & Foundry Co. Patent 1,856,874.

Embossing Sheet Metal. William J. Pannier, Jr., Pittsburgh, Pa., assigned to Pannier Brothers Stamp Co. Patent 1,856,928.

Furnaces

Annealing Furnace. Howard A. Kenworthy, Woodbury, Conn. Patent 1,856,563.

Pipe Annealing Furnace. Stuart B. Clark, Riverton, N. J., assigned to United States Cast Iron Pipe & Foundry Co. Patent 1,856,863.

• TRADE PUBLICATIONS •

BROACHING MACHINES. American Broach & Machine Co., Ann Arbor, Mich., has issued a booklet on "Vertical Pull-Type American Broaching Machines," illustrating the complete line and describing design elements and specifications.

DIEHEADS. Geometric Tool Co., New Haven, Conn., has issued two new booklets covering the company's K line of dieheads, one describing the Style KH stationary self-opening dieheads and the other the Style KD rotary self-opening dieheads. The first style is for use in hand screw machines, turret lathes, and similar equipment, the second for use in live spindle machines.

GRINDING MACHINE. National Tool Co., Cleveland, Ohio, has issued a booklet illustrating and describing the National-Cleveland radial helicoid grinding machine, described recently in *American Machinist*.

LOCK WASHERS. Shakeproof Lock Washer Co., 2501 North Keeler Ave., Chicago, Ill., has issued a folder describing Shakeproof lock washers and their uses and offering free samples to interested parties.

IMMERSION HEATING UNITS, ELECTRIC. H. O. Swoboda, Inc., 3530 Forbes St., Oakland Station, Pittsburgh, Pa., has issued Bulletin No. 270, illustrating and describing one type of the "Falcon" bare electric immersion heating units suitable for large tanks for viscous materials which are electrical insulators.

ROLLER BEARINGS. Hyatt Roller Bearing Co., Newark, N. J., is celebrating its fortieth birthday with an anniversary book showing steps in the production of the company's roller bearings and types of bearings manufactured.

American Machinist
Reference Book Sheet

INVOLUTE SPUR GEAR BLOCK GAGING

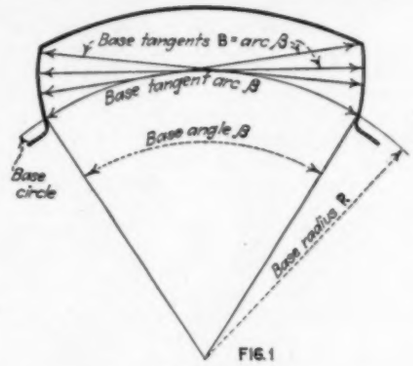


FIG. 1

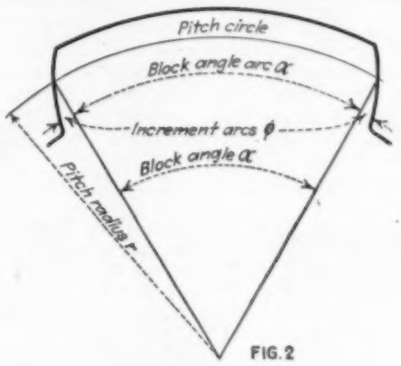


FIG. 2

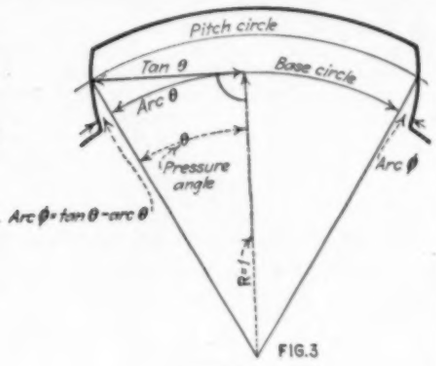


FIG. 3

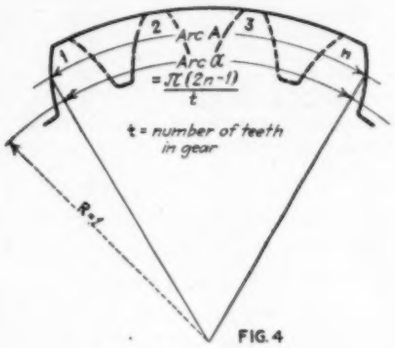


FIG. 4

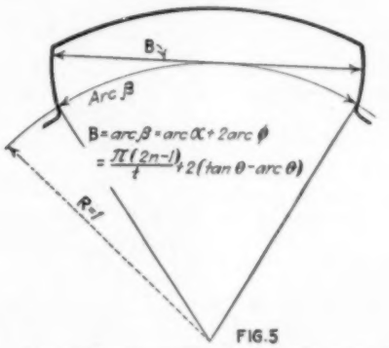


FIG. 5

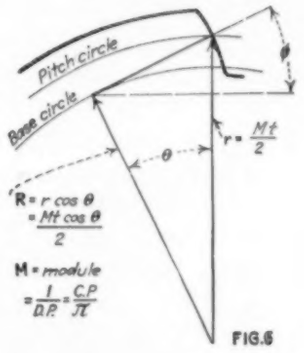


FIG. 6

It is required to determine W

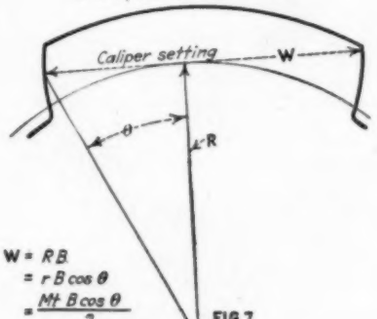


FIG. 7

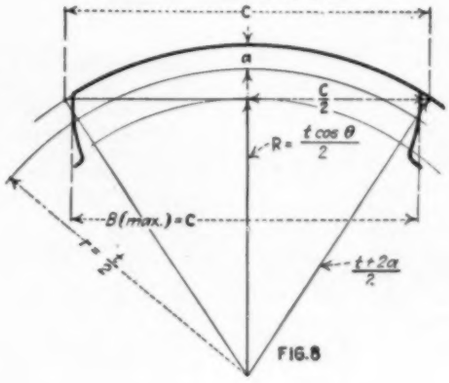


FIG. 8

$\frac{C}{2} = \sqrt{\left(\frac{t+2a}{2}\right)^2 - \left(\frac{t\cos\theta}{2}\right)^2}$

$C = \sqrt{(t+2a)^2 - t^2\cos^2\theta}$

= maximum value for B in a gear of unity module or 1 D.P.

C (actual) = M.C.

In standard gears the addendum a = 1. In stub gears it should be given the value it would have in a gear of unity module or 1 D.P. of the same tooth proportions

$W = RB$
$= r B \cos\theta$
$= \frac{Mt\,B\cos\theta}{2}$
$= \frac{Mt}{2}\left[\frac{\pi(2n-1)}{t} + 2(\tan\theta - \text{arc}\,\theta)\right]\cos\theta$
$= M\left[\frac{1}{2}\pi(2n-1) + t(\tan\theta - \text{arc}\,\theta)\right]\cos\theta$, in which
(Table II) (Table III) (Table III)

M = Linear units (inch, metric, or other) in the pitch diameter for every tooth in the gear
$= \frac{1}{D.P.} = \frac{C.P.}{\pi}$, and values of M for circular pitches and other terms appear in the accompanying tables. The tables list also the values of the cosines squared of pressure angles with their logarithms

Explanation and discussion on next page

TABLE I — VALUES OF "M"

Diametral Inch-modules corresponding to Standard Circular Pitches

Circ. Pitch	1/4	5/16	3/8	7/16	1/2	9/16	5/8
Module (M)	0.03979	0.05968	0.07958	0.09947	0.11937	0.13926	0.15916
Log M	2.59976	2.77585	2.90079	2.99770	1.07688	1.14383	1.20182
Circ. Pitch	5/8	3/4	7/8	1	1 1/8	1 1/4	1 3/8
Module (M)	0.17905	1.19894	0.21884	0.23873	0.25863	0.27852	0.29842
Log M	1.25297	1.29873	1.34012	1.37792	1.41267	1.44486	1.47482
Circ. Pitch	1	1 1/8	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4
Module (M)	0.31831	0.35810	0.39789	0.43768	0.44746	0.51725	0.55704
Log M	1.50285	1.55400	1.59976	1.64115	1.67894	1.71370	1.74589
Circ. Pitch	1 1/2	2	2 1/4	2 1/2	2 3/4	3	3 1/4
Module (M)	0.59683	0.63662	0.71620	0.79577	0.87535	0.95493	1.03451
Log M	1.77585	1.80388	1.85503	1.90079	1.94218	1.97997	0.01473

TABLE II — VALUES OF "N" = $\frac{1}{2}\pi(2n-1)$

for different values of n

n	1	2	3	4	5	6	7	8
N	1.57080	4.71239	7.85398	10.99557	14.13717	17.27867	20.42035	23.56194
n	9	10	11	12	13	14	15	16
N	26.70354	29.84513	32.98672	36.12832	30.26991	42.41150	45.55309	48.69469
n	17	18	19	20	21	22	23	24
N	51.83628	54.97787	58.11946	61.26106	64.40265	67.54424	70.68583	73.82743

Note that "N" also equals $(n - \frac{1}{2})\pi$

TABLE III — TRIGONOMETRICAL CONSTANTS

for different Pressure Angles θ

θ	14½	15	17½	20	22½	25	27½	30
Cos θ	0.96815	0.96592	0.95372	0.93969	0.92388	0.90631	0.88701	0.86603
Log cos θ	1.98594	1.98494	1.97942	1.97299	1.96562	1.95728	1.94793	1.93753
Cos² θ	0.93731	0.93300	0.90958	0.88302	0.85356	0.82140	0.78679	0.75001
Log cos² θ	1.97188	1.96988	1.95884	1.94597	1.93123	1.91455	1.89586	1.87507
Tan θ — θ	0.00554	0.00615	0.00987	0.01490	0.02151	0.02998	0.04060	0.05375
π cos θ*	3.04154	3.03454	2.99621	2.95213	2.90246	2.84726	2.78663	2.72072

*π cos θ = Base Pitch (linear pitch along the line of action or circular pitch at the base circle) corresponding to 1 in. Module or 1 mm. Module or 1 Diametral Pitch.

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Reference Book Sheet

INVOLUTE SPUR GEAR BLOCK GAGING

GAGING the teeth of gears by sections or blocks has its advantages and, in the block-indexing system of gear-cutting, its conveniences. Unfortunately, data that exist for gaging by single teeth are lacking, necessitating long and tedious calculation for each case. Here are provided simpler formulas and a number of tables from which the unknown values in the formulas can immediately be drawn. Every effort has been made to make the treatment as simple as possible.

Derivation of Formula for Tooth Block Width

Since, if the base tangent B, Fig. 1, were rocked without slip upon the base tangent β (part of the base circle), it would trace out the opposing involute profiles of the tooth block, it follows that any such tangent is equal to the base tangent arc, the arc subtending the base angle β; that is, in the shape of a formula

$$B = \text{arc } \beta \quad \ldots\ldots(1)$$

Now, the arc β is composed of the block-angle arc α, Fig. 2, and the two equal, small, increment arcs ϕ, from which it is evident that

$$\text{arc } \beta = \text{arc } \alpha + 2 \text{ arc } \phi \quad \ldots\ldots(2)$$

But each increment arc ϕ, if the base radius R be unity, is equal to the difference between the tangent of the pressure angle Θ, Fig. 3, and the arc Θ subtending the same angle. That is,

$$\text{arc } \phi = \tan \theta - \text{arc } \theta \quad \ldots\ldots(3)$$

in which the angle Θ is known (it is the given pressure angle), both its tangent and its arc being, therefore, ascertainable from hand-book tables of tangents and of the circular measure of angles, or from Table III for prevalent pressure angles.

Manifestly, formula (2) can now be re-written

$$B = \text{arc } \alpha + 2 (\tan \theta - \text{arc } \theta) \quad \ldots\ldots(4)$$

not forgetting, however, that the base radius is at the moment supposed to be 1.

It will be remarked that the angle α is not only under the arc α, but under the arc A at the pitch circle. And the arc A contains, in standard gears, a number of equal space and tooth arcs less by 1 than twice the number of teeth in the block. If, then, the number of teeth in the block be denoted by n, and the number of teeth in the gear by t, it follows that the arc A, and consequently the arc α, is equal to the circumference of its own circle divided by twice t and multiplied by $(n - 1)$. If the base radius is 1, as in Fig. 4, the corresponding circumference is, of course, equal to 2π and the length of the arc α equal to

$$\frac{2\pi (2n - 1)}{2t} = \frac{\pi (2n - 1)}{t}$$

But B is equal to the arc α and the two arcs ϕ; therefore,

$$B = \frac{\pi (2n - 1)}{t} + 2 (\tan \theta - \text{arc } \theta) \quad \ldots\ldots(5)$$

as Fig. 5 shows. It is now clear that solution of this equation will yield the value of B for gears having a base radius of 1. It is equally evident that the value so obtained need only be multiplied by the base radius of the actual gear to give the width of the block of that gear.

From Fig. 6, in a gear of pitch radius r the base radius R is equal to $r \cos \Theta$, this angle being the pressure angle. If the module system of pitch measurement is adopted in which the module M represents the linear units in the pitch diameter for each tooth, in the actual gear:

$$R = \frac{Mt \cos \theta}{2} \quad \ldots\ldots(6)$$

It may here be noted, too, that M is the reciprocal of the diametral pitch, being equal to $1/D.P.$ and is also equal to the circular pitch divided by π $(C.P./\pi)$. In (6), t represents the number of teeth in the gear, as before.

From Fig. 7 it should now be apparent that the caliper setting W of the actual gear is ascertainable by the formula

$$W = M \left[\tfrac{1}{2}\pi (2n - 1) + t (\tan \theta - \text{arc } \theta) \right] \cos \theta \quad \ldots\ldots(7)$$

rather formidable to solve unless one knows that in the accompanying tables have been tabulated the values of $\frac{1}{2}\pi(2n - 1)$, of tan Θ — arc Θ, of cos Θ and of M for circular pitches.

Formula for Maximum Block Width

The base tangent W, Fig. 7, must not exceed, indeed should be a little less than, the base tangent chord C, Fig. 8. Where doubt exists C should be calculated. For unity module, the formula, whose derivation the diagram (Fig. 8) shows, is

$$C = \sqrt{(t + 2a)^2 - t^2 \cos^2 \theta} \quad \ldots\ldots(8)$$

The value for C thus ascertained can be compared with the value of W as determined by formula (7) before multiplying by the module M; or C (actual) may be determined by the formula

$$C \text{ (actual)} = M.C \quad \ldots\ldots(9)$$

Where the addendum a for unity module or unity diametral pitch is 1, formula (8) may be rendered

$$C = \sqrt{(t + 2)^2 - t^2 \cos^2 \theta} \quad \ldots\ldots(10)$$

In the Fellows stub system, a should be given the value it would have in a unity-module gear of the same tooth proportions. The value of a is determinable by the formula:

$$a \text{ (for unity module)} = \frac{a \text{ (actual)}}{M \text{ (actual)}} \quad \ldots\ldots(11)$$

It should be noted that the module corresponding to a diametral pitch is the reciprocal of the pitch. Hence, in solving the above equation for a diametral pitch, we simply divide the figure denoting the pitch by the figure whose reciprocal represents the addendum. For 6/8 *D.P.* gears, for instance:

$$a \text{ for 1-}D.P. = \frac{1/8}{1/6} = \frac{6}{8} = 0.75 \text{ in.}$$

For ½-in. module, the actual addendum being 0.375 in.;

$$a \text{ for 1-in. module} = \frac{0.375}{0.5} = 0.75 \text{ in.}$$

For 4/3-mm. module, the procedure would be

$$a \text{ for 1-mm. module} = \frac{3}{4} = 0.75 \text{ mm.}$$

When cutting by the "block-indexing" system, and the gears must be gaged either while setting the cutter to depth, or as cutting proceeds, it is essential that the number of teeth indexed at a time should not only not exceed the number of teeth the chord C, Fig. 8, can contain, but that the number be prime to (not a sub-multiple of) the number of teeth in the gear.

The tables will be found serviceable for problems other than that for which they were originally prepared. Table II, for instance, lists multiples of "pi" up to 24 from which half of "pi" has been subtracted.

It may be remarked that the logarithms do not always correspond to the corresponding numbers. Analysis will reveal, however, that both numbers and logarithms are correct to the fifth decimal place if they are referred back to the values from which they originate.

Contributed by Francis W. Shaw

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EDITORIALS

May 12, 1932

K. H. CONDIT • F. H. COLVIN
Editors

Penny Pinching

No one can blame company executives for tightening up on expenditures during these days of low sales. But arbitrary rulings are always dangerous and often expensive.

One supplier of equipment to the automobile plants recently received an inquiry on all parts for a certain machine in his line. Of course the total of these parts would greatly exceed the price of the complete machine. He learned, however, that though equipment purchases were strictly taboo, the company submitting the inquiry still approved requisitions for necessary repairs. Some bright individual had rediscovered the old scheme of buying a much needed machine in pieces rather than doing without it.

While this case is extreme, it illustrates the absurdity of some of the rigid rules on economy in force today. Broader perspective is essential to true economy. There is no use pinching pennies with one hand and allowing dollars to slip through the other.

What-Hour Week?

How many hours will constitute a "normal" working week for metal-working shops when business has come back to what we will consider "normal"? One of the larger automobile plants is now working twelve to sixteen hours per week, but the total of labor hours per car is less than half of what it was in 1929, not because of driving the men, but because of increased efficiency and economies in shops, tooling and management. A large typewriter plant is working only two days per week, but with exactly one fourth the labor hours it is turning out half as many machines as in 1929. In both these instances, the products being turned out are of higher quality than those of three years ago.

Such is the advance of labor-saving equipment and mechanical efficiency in the machine age! How many hours do we need? Robert Drake, formerly consulting engineer for the International Harvester Company, states that the average manufacturing industry with overhead set for a single nine-hour shift, five and one-half days, or fifty hours a week, actually operates at an average of only sixty per cent of capacity over a ten-year period. The experience of the machine tool industry bears out this statement.

That means an actual present average of thirty hours a week in industries operating as the metal-working industry operates. Why not face facts squarely, admit that overhead should be calculated on a shorter week, and then swing to the shorter week as a normal? Such action would be a stabilizing influence even if it did not take up the slack of unemployment immediately.

Seeing Is Believing

Boiler pressure, draft, water height and dozens of other things are recorded visually in the modern power house. But on machine tools, where control must be more accurate and constant, only comparatively rough control equipment is provided. Gages and meters have been applied, but only desultorily; several articles in *American Machinist* have recommended some such development for several years past; now German milling machines incorporate them.

The milling machines shown at the Leipzig Fair, illustrated on pages 632e and 632f of this number, are examples. Various machines provide speedometers, "feedometers," hydraulic pressure gages, and similar devices. One shows spindle revolutions and table feed on a dial, another shows them in an illuminated window, still another shows pressure on the hydraulic system

to permit close check on tool dullness. Thus the operator has constantly before his eyes an accurate and easily understood indication of just exactly what is happening on his machine. This may be a point worthy of notice by American machine tool designers, worthy of consideration in design and redesign. Seeing is still believing, and visualization is still the best method of control.

• CHIPS •

"Issue is between the people and the locust swarm of lobbyists who haunt the halls of Congress" . . . Tardy but determined, thus President Hoover appeals directly to the public . . . following his statement to Congress that "disastrous uncertainty" of budget and tax delays retards business . . . Senate committee responds by reporting billion dollar tax bill . . . including import taxes on oil, copper, coal, lumber, crude rubber . . . But Administration favors putting savings first and trimming taxes to suit . . . Ways and Means Committee votes down cash bonus proposals . . . but House approves $100,000,000 in pensions for widows of war veterans . . . National Economy committee headed by Capt. Archie Roosevelt sees "vast legalized abuse" in veterans' aid . . . says $450,000,000 can be saved without injustice . . . Bill to restrict rail holding companies goes to House.

Far from unanimous are opinions as to exact meaning of the Goldsborough bill . . . some say mild recommendation . . . some say enforced inflation . . . Designed to stabilize dollar and restore commodity prices . . . its passage in House has already weakened dollar in foreign markets . . . But Europe seems more excited about it than U. S. . . . 42 per cent crop cut forecast . . . If this comes true, commodity prices may restore themselves . . . R. O. T. C. and C. M. T. C. may go as Army appropriation is cut . . . Congress may indorse company unemployment reserves . . . and reduce corporation taxes on them . . . House votes Federal operation of Muscle Shoals . . . Democratic deadlock looms as Garner checks Roosevelt in California . . . Dark horses' prospects brighten.

Bank clearings up a billion dollars in week . . . Steel workers pay cut 15 per cent . . . Railroaders' turn may come again . . . Plants making smallest cuts get most business, cost accountants find . . . refuting theory that low wages stimulate trade . . . American Central Life cuts wages 20 per cent . . . but applies reduction against employees' insurance . . . Tariff Commission finds half U. S. imports come from nations off gold standard . . . Borah's formula for recovery . . . disarmament, settlement of reparations, restoration of silver . . . Charles E. Hughes says despair pays no dividends.

World joins France in mourning as assassinated President Doumer is buried in state . . . Albert Lebrun a likely successor . . . Meanwhile Tardieu supporters go down to defeat . . . Private trading recognized in Russia . . . as peasants are permitted to sell surplus crops . . . Compulsory 40-hour week advocated in Germany . . . Financing arranged for 300,000 tons of German steel ordered by Soviet . . . Moscow grants $8,000,000 credit to Turkey . . . to be used against purchases . . . G. M. export head, Mooney, finds things brighter in Europe . . . but Corporation reduces dividend to 25 cents per quarter . . . Boycotts no aid to peace says Acting Secretary of State Castle.

> Close to the three-quarter mark is the United Action Drive to put 1,000,000 men to work . . . Latest figures are 722,794 employed in 2,849 communities . . . 54,187 above last week.

Ford assembly plants employ more men . . . 1,800 at Norfolk, Va., alone . . . $6,000,000 to $10,000,000 to be spent this year on underground equipment by the Philadelphia & Reading Coal, Iron & R. R. Co. . . . Chesapeake & Potomac Telephone Co. will construct new exchange . . . to cost $1,700,000 . . . Charles H. Bacon Co. installs another car load of full-fashioned hosiery machinery . . . Contracts for a new plant amounting to $2,000,000 awarded by National Portland Cement . . . One of world's largest factories now rising in Wyandotte, Mich. . . . to be used by Michigan Alkali Co. . . . and will make 150 tons of solid carbon dioxide per day . . . Building & Loan League predicts $25,000,000 expenditure on home repairs and improvements in next few months . . . but cites need for better financing facilities . . . 1932 gold rush greater than 1848 . . . Urge is especially strong in Canada where gold is at a premium and currency depreciated . . . Airplanes transported 31 per cent more passengers in first quarter than in 1931 . . . flew 5,000,000 more miles . . . and carried 36 per cent more freight.

· REGIONAL · REPORTS ·

EVEN New York, which last week felt somewhat optimistic, has joined the rest of the country in inactivity. It has been long since the last report of any sizable order for machine tools. For months almost the only sales have been those to the government (Navy), a few to auto and accessory manufacturers, and the remainder occasional single tools, mostly special purpose, for small industrial concerns. With the stodgy months of summer fast approaching, the outlook for any considerable improvement hardly can be called bright. Even with Washington on the way to sanity, little improvement is likely before fall.

NEW YORK had a very quiet week at best. The largest sale reported during the week consisted of four shapers for the Navy. New England is dickering with Amtorg over an order for grinding machines, terms as usual causing delay. Cincinnati sees no signs of improvement. Chicago detects chances of a pick-up though dealers retrench. Railroad applications for loans from R.F.C. give Indianapolis hopes of tool orders. Detroit, just now dull, sees possibilities in Ford production increase. Quietness continues in the Southern district while the government gives Pacific trade its only sustaining business.

NEW YORK—Optimism over the slight increase in machine-tool business reported last week was dampened considerably by dullness of the period just ended. Little important business was done. Sales consist of tools for special purposes where a dealer has been able to show lower-cost production. One dealer sold four shapers to the Navy.

NEW ENGLAND—No definite evidence of improved machine tool market. April probably poorest ever experienced by the industry. Grinding machine centers anticipating completion of negotiations by Amtorg. Terms demanded make this business unattractive, but will probably be accepted. Navy scattering small but consistent amount of business. Two metal-working companies purchased single machine units, one costing $25,000. Otis Elevator has order for new elevators to be installed in Hartford department store at cost of $30,000, also government orders.

CINCINNATI—Manufacturers and selling agents see no market improvement. A small volume of business came from scattered general machinists and miscellaneous users requiring single tools. Inquiries are fairly plentiful but rarely productive.

CHICAGO—Several promising inquiries, including one for a special 1000-ton forging press, bring hopes of a turn out of the slump this district felt during April and still feels. Dealers are stripping overhead and consolidating quarters. A few single sales were reported. One, for a centerless grinder, had been pending five years.

INDIANAPOLIS—With railroads going to Reconstruction Corporation for money, tentative feelers are out in the local territory for machine tools. No lists are out as yet, but increased activity is noticed in most Indiana shops. Inquiries come from refrigerator factories. Officials anticipate good business. Steel trade demand dull. Some items bought by farm implement factories, garage and accessory men, and by airports, but automobile demand is far off. Some sales to rock crushers and sand and gravel plants.

DETROIT—The long period of quiet continues with little hope of improvement before September. Dealers in machinery, machine tools and miscellaneous equipment used in automotive manufacture seem to be convinced they will do little business during summer. Two large auto plants are closed down, several running on low schedules, and one or two others failed to issue anticipated heavy orders for equipment. However more small tools and small equipment are being purchased. There is an increasing tendency toward experimental work, improvement, repair and research. Increase in Ford production may give rise to considerable machinery purchases.

SOUTHERN DISTRICT—Quietness continued in machinery and machine-tool market the past fortnight. Sales scattered and diversified. Small-tool sales constituted bulk. Business brightest in New Orleans area. Texas exceedingly quiet with little immediate recovery anticipated. Lower Eastern seaboard States stagnant. Railroad and shipyard buying negligible. Industrial inquiry chief supporting factor of trade. Deliveries good, stocks at minimum, prices unchanged. Some slipping of scales among small-tool manufacturers.

PACIFIC NORTHWEST—Machine tool and equipment market conditions are probably no worse than heretofore this year. Seasonal turnover is far below normal years. One local manufacturer of automotive tool specialties is extremely busy. There is no industrial demand and recent purchases have been mostly for the government.

MATERIAL TRENDS AND PRICES

Requirements of the automotive industry will constitute the main outlet for steel in the near future, unless railway buying recovers shortly from its present downward trend. Agricultural implements and construction offer no prospects of immediate improvement in demand for metals. The present rate of steel-mill operations, 24 per cent of capacity, is approximately the weekly average for this year, thus far . In non-ferrous metals, advances in tin have been offset by declines in copper and zinc. Scrap prices change little despite presence of excessive supplies. Iron and steel scrap appears to be more adversely affected than are the non-ferrous descriptions.

(All prices as of May 6, 1932)

IRON AND STEEL

Pig Iron —	Current	Mo. Ago	Yr. Ago
Birmingham, No. 2, Fdry., per gross ton	$11.00	$11.00	$12.00
Buffalo, No. 2, Fdry., per gross ton	16.00	16.00	17.10
Heavy Melting Steel Scrap — Pittsburgh consuming point, No. 1, per gross ton	9.75	10.00	11.25
Furnace Coke — Connellsville, per net ton	2.25	2.25	2.50
Foundry Coke — Connellsville, per net ton	3.25	3.25	3.25
Steel Shapes — Pittsburgh, base, per 100 lb	1.50@1.60	1.50@1.60	1.65

•

Iron Machinery Castings — Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight, 275 lb:

Chicago	4.62½	Cleveland	4.50
Cincinnati	4.35	Detroit	4.00
New York	4.75		

•

Steel Sheets — Prices in cents per lb., del. from warehouse stock (except at Pittsburgh) in lots of 401 to 999 lb., ordered and released for shipment at one time:

	Pitts. Mill	Chicago	Cleveland	New York
Hot-rolled, No. 10	1.55	3.20	3.00	3.00
Hot-rolled, No. 24*	2.20	3.55	3.25	3.50
Galvanized, No. 24	2.85	4.10	3.75	4.00

*Annealed

•

Seamless Steel Tubing — Cold-drawn mechanical tubing, round, .10 to .30 carbon, in lots of less than 100 ft. or 100 lb., net, at N. Y. warehouse:

Thickness of Wall		Outside Dia. in Inches						
Inches	B.w.g.	⅛	¼	⅜	½	1	1¼	1½
		Price per Foot						
.035	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23

•

Shapes, Plates, Bars, Etc. — Warehouse base prices in cents per lb., del. in lots of 401 to 999 lb., ordered and released for shipment at one time:

	New York	Cleveland	Chicago
Bands	3.40	3.00	2.95
Bars, soft steel	3.10	2.75	2.75
Cold fin., flat or square	3.80	3.60	3.60
Cold fin., round or hexagon	3.30	3.10	3.10
Cold rolled strips	4.95	5.95	5.50
Floor plates	4.85	5.00	5.00
Hoops	3.75	3.55	3.50
Rivets	4.00	3.30	4.00
Shapes	3.10	2.95	3.00
Spring steel	4.00	4.00	4.00
Tank plates	3.10	2.95	3.00

•

Stainless Steel — Hot-rolled bars, base, Pittsburgh, 0.12 per cent carbon, cents per lb.:

Chromium		Chromium	
15% and under	19.00	18 to 23%	23.00
15 to 18%	20.50	23 to 30%	28.00

Bolts and Nuts — Discount from list, f.o.b. mills, Birmingham, Chicago, Cleveland and Pittsburgh, on bolts (except stove), nuts, and lag screws, mill lots 75%

NON-FERROUS METALS

Prices following are in cents per lb. for mill shipments in carlots:	
Aluminum ingots 99%, N. Y.	23.30
Copper, electrolytic, Conn	5.62½
Copper wire, base, Chicago and Cleveland	8.62½
Copper wire, base, N. Y.	8.50
Lead, pigs, E. St. Louis	2.90
Tin, Straits, pigs, spot, N. Y.	20.45
Zinc, slabs, E. St. Louis	2.55
Prices following are in cents per lb., base, N. Y., Chi. and Cleve.:	
Brass rods, high	10.25
Brass sheets, high	12.50
Brass tubing, high	15.75
Copper, drawn round	12.87½
Copper sheets	15.37½
Copper tubing	14.87½
Prices following are in cents per lb., del. from N. Y. warehouse:	
Babbitt, anti-friction, general service	27.00
Babbitt, com'l, intermediate grade	32.75
Babbitt, genuine, highest grade	41.50
Solder, bar	16.00
Prices following are in cents per lb., base, Huntington, W. Va.:	
Monel metal rods, hot rolled	35.00
Monel metal sheets, full finished	42.00
Monel metal tubing, seamless	65.00
Nickel rods, hot rolled	45.00
Nickel sheets, full finished	52.00
Nickel tubing, seamless	75.00

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Scrap Non-Ferrous Metals — Dealers' purchasing prices in cents per lb., f.o.b. cars:

	New York	Cleveland	Chicago
Heavy yellow brass	2.00	1.75	1.50
Light brass	1.50	1.25	1.25
No. 1 rod-brass turnings	2.25	2.00	1.50
Heavy copper	4.00	2.75	2.75
Light copper	3.25	2.50	2.37½

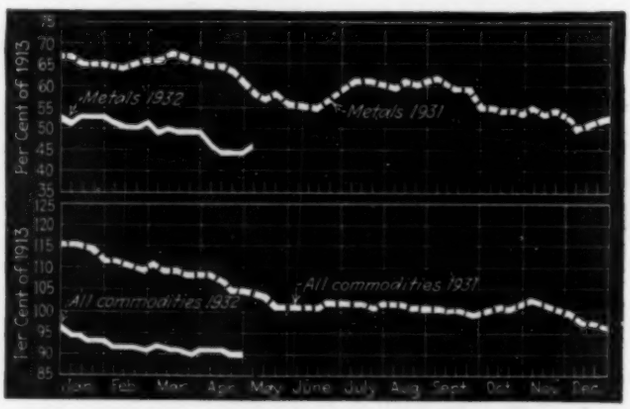
SHOP SUPPLIES

(Prices at warehouse)	New York	Cleveland	Chicago
Abrasive disks, aluminum oxide No. 50 grain, cloth, 6-in. dia., X weight, per 100	$4.37	$4.59	$4.59
Belting, leather, heavy	40–5%	40–5%	40–5%
Belting, rubber, trans., Grade 1	60–10–10%	60–10%	60–10%

Lumber — Per M ft., b.m., 12–16 ft. lengths, delivered, N. Y.

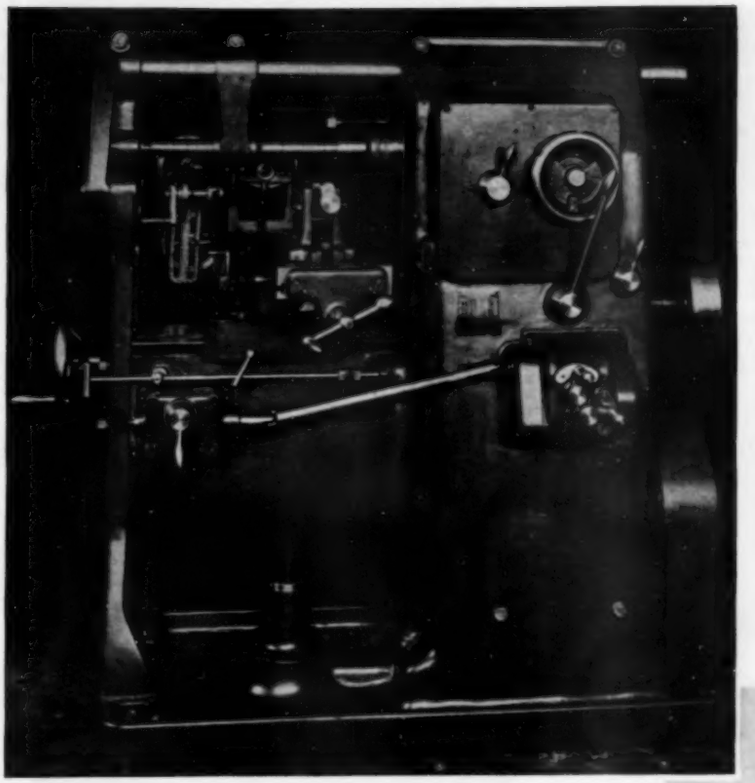
Crating — Southern pine:
1x4-in., sq. ed. ..... $27.00 1x6-in. $24.00

Skids — Spruce:
2x4-in. .$35.00 3x4-in. .$35.00 4x6-in. .$37.00 6x6-in. .$50.00


Per Cent of 1913
Metals 1932
Metals 1931
Per Cent of 1913
All commodities 1931
All commodities 1932
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.

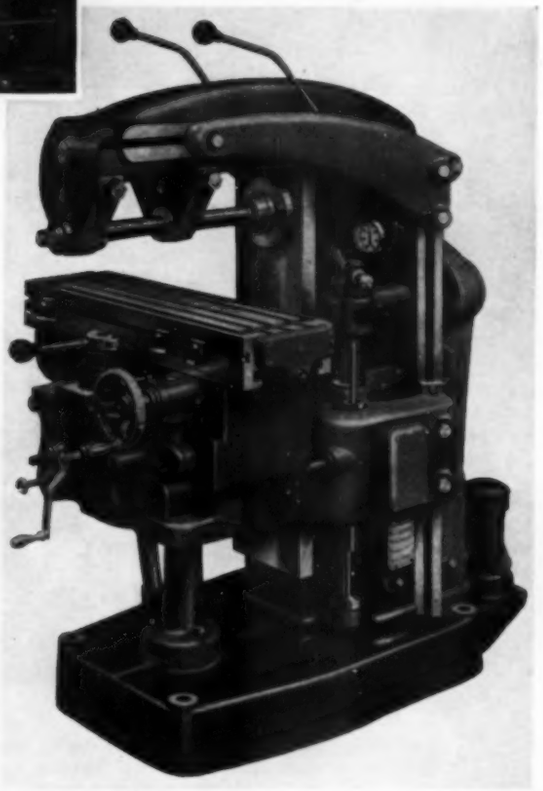
Price Movements Week by Week

Average Price of Raw Metals: Pig Iron, Billet Steel, Copper, Tin, Lead, Zinc—American Machinist
Seventy-Four Commodities Index—The Annalist

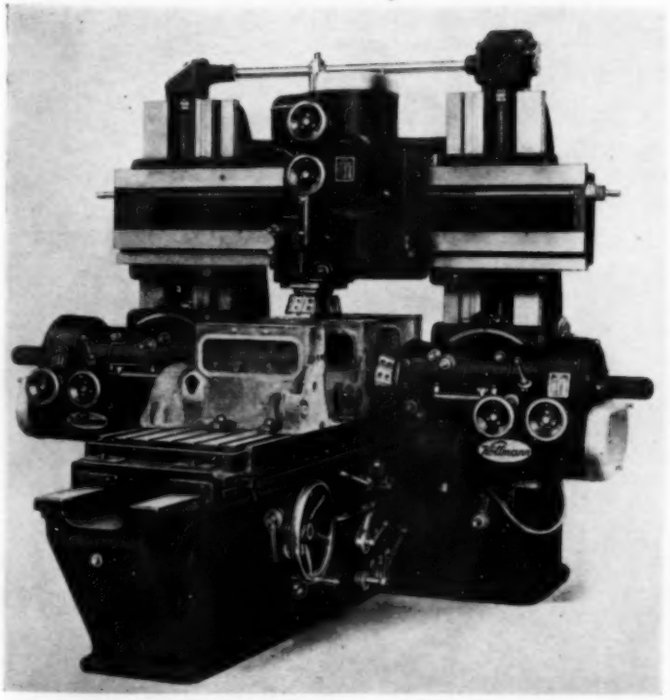


Left—This universal milling machine has a 42½ x 9-in. table, and 8 cutter spindle speeds in 1.41 ratio. A frame brace connects the overarm with the knee and column. Standard motors, placed low to lessen vibration, are used instead of the flange-mounted type. Shown by Arno Krebs, Leipzig

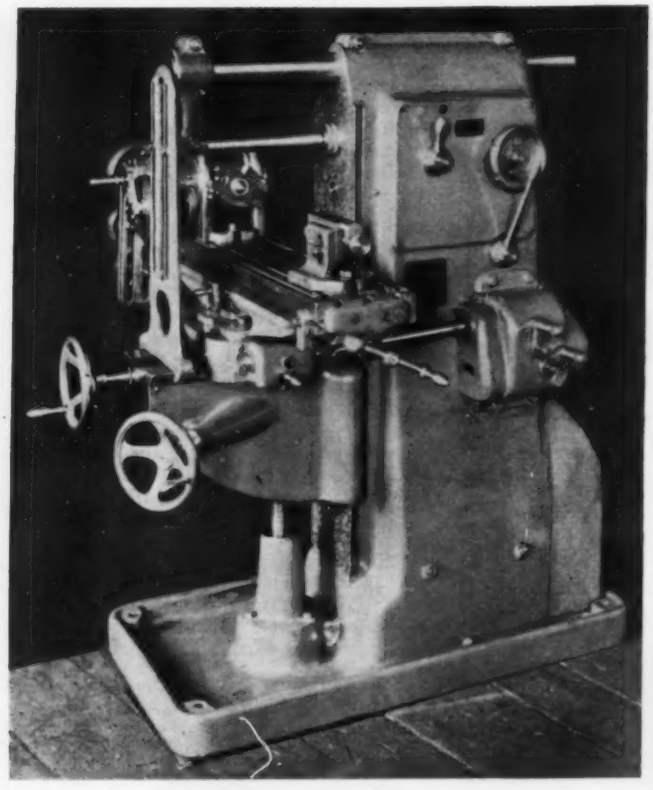
Below—One Wandererwerke milling machine has an unusual arrangement for taking up cutter pressure. An overhanging arm of peculiar shape is supported by two lateral braces in place of the usual shears, leaving the table freely accessible and vertically adjustable to reduce handling time. The knee is likewise braced by two lateral braces which slide on surfaces of the column, to which they may be clamped by screws. A single lever controls feed, rapid travel, rapid return, cutter spindle drive and flow of coolant. Spindle speeds are variable between 48 and 2,100 r.p.m.



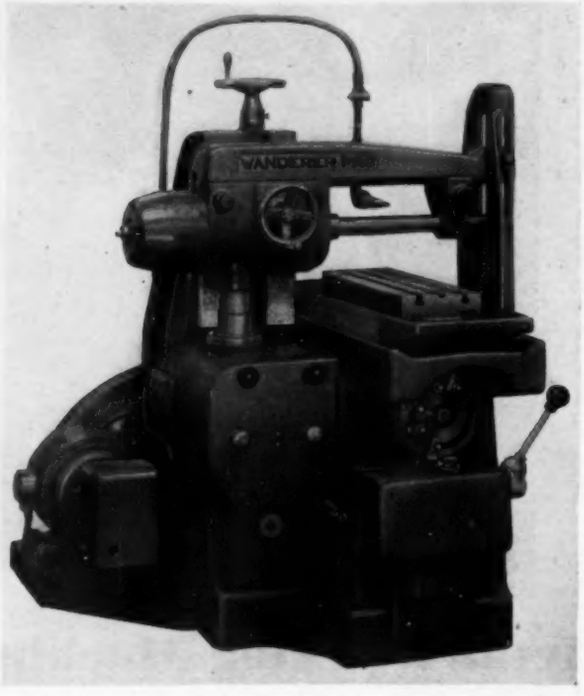
Metal-Working Machines at the 1932 Leipzig Spring Fair



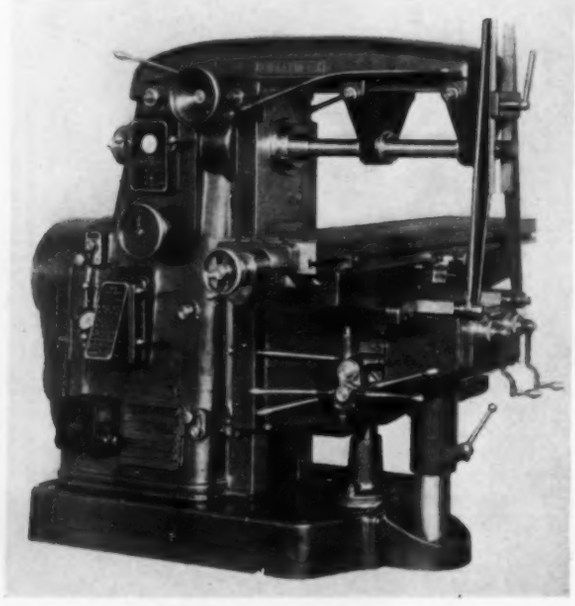
Left—Planer type milling machine shown by Kollmann-Werke, Leipzig, has milling heads and table driven by 8-hp. flange motors. Push-button control is fitted on both sides, and one lever on each side controls feed and table rapid traverse. When the table reverses, milling heads stop automatically. Twelve milling head speeds are available, obtained by means of a 6-speed sliding backgear and two sets of change gears. Twenty-four table speeds are provided, and feeds from 54 to 600 mm. per min. The machine will cut 16.7 kg. per hp.-hr. in cast iron



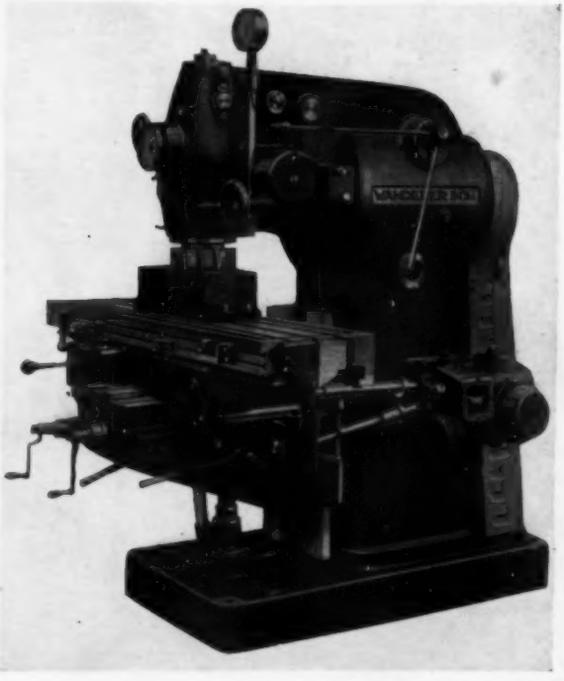
Left—This universal milling machine has a 36 x 8¼-in. table. Drive is either through a 1,500-r.p.m. standard motor in the base over Renold chain or by single pulley belted directly to the lineshaft. Six speed changes with a 1.58 ratio of progression are provided, though speeds available may be doubled with a pole-change motor. Twelve variations in the feed gear box in a 1.26 ratio of progression are independent of cutter spindle speed. Circular tables are available. Shown by Arno Krebs, Leipzig



Above—In this semi-automatic horizontal milling machine by Wanderer-Werke, Chemnitz, a single lever controls feed, rapid travel, rapid return, revolution of cutter spindle and flow of coolant. Engaging the feed turns on the cutter and coolant. Shifting the lever to rapid travel or return stops the cutter and turns off the coolant. Table motion is 9¾ in. through a hardened cam, independent of length of cut. Adjustable dogs on the control disk at right are set for proper cutter feed. Another machine shows feed and direction of travel in an illuminated window



Above—This horizontal milling machine has power rapid traverses in each table direction. Feeds and spindle speeds are controlled by levers and a handwheel on the left-hand side. Directions and power rapid traverses are controlled by two levers operating from either front or drive side of the machine. A T-handle changes feed direction. Spindle feed and table feed are read from the speedometer and feedometer at left. Driving motors are placed at the back out of the way. Shown by Biernatzki-Chemnitz, Sachsen.



Right—This vertical milling machine has a hydraulically driven cutter spindle with speeds from 20 to 1,000 r.p.m. A speedometer on the spindle head indicates the spindle r.p.m. and linear speed of the cutter. Pressure in the hydraulic system is shown on a gage which serves as a check of the tool sharpness. Shown by Wandarer-Werke.

Government Alone Has Power to Lead Country Out of Depression

"Banking Mechanism Will Take No Responsibility for Control" says Flanders, "Business is Helpless . . . The Government is the Remaining Resource"

"MANAGEMENT is faced by the impact of forces beyond its control," RALPH E. FLANDERS, vice-president, Jones & Lamson Co., said at the Annual Spring Convention, American Management Association, Hotel Pennsylvania, New York City, May 3-4. "It has studied questions of product, plant and equipment, personnel selection and direction, wage incentives, production control, sales and advertising management and proper financial control. Effective techniques have been developed, but they are not sufficient to insure success under all conditions," he continued.

"To meet broader problems trade associations have been formed," Mr. Flanders pointed out. "These by approved codes of ethics restrain unfair competition. By gathering and publishing statistics of production and sales they may check unwise expansion. By establishing uniform cost systems they discourage unprofitable prices.

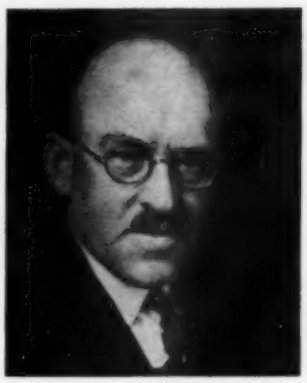
"There are other types of disturbance which even the trade association cannot easily cope with, such as the obsolescence of whole industries by new developments, and by radical changes in fashions," he declared. "But the greatest uncontrolled factor is dependence on general business conditions.

"Industry's necessary activities tend to set up disturbing forces. Economy in production causes labor unemployment and reduces purchasing power. The laying aside of large cash reserves tends to withdraw funds to activities which do not result in the purchase of goods.

"The actual process of boom and collapse are clear," Mr. Flanders pointed out. "Accumulated profits of individuals and companies seek investment. There being no expansion of purchasing power to correspond, profitable new investment does not appear. But the emergence of profits enhances the security market which absorbs them in speculation. This pyramids into a speculative structure whose foundation is undermined by the withdrawal of these funds from purchasing power. The structure collapses.

"The banking mechanism will take no responsibility for control," he continued. "It is engaged in an essentially short-view business undertaking. Business is helpless. The government is the remaining resource.

"The government can do certain things to maintain the balance. An arbitrary shortening of the working hour is one possibility which is hopeful, but highly controversial. Another, as hopeful, but less controversial, lies in its budgeting and construction policy.



RALPH C. FLANDERS
Speaker at A.M.A. Meeting

"In the present situation measures for expanding and easing credit are admirable, but are business operations in sight which can employ the credit?" Mr. Flanders asked. "Extreme budget balancing throws men out of work and decreases purchases of goods. This works directly opposite to credit expansion and may negative its effect. It is most unfortunate that budget balancing and credit expansion are simultaneous. The latter should have been effected months ago, in which case governmental contraction would not have been serious.

"The desirable policy," Mr. Flanders said, "is to withdraw from extremes of budget balancing; to discriminate between current receipts and expenditures and capital expenditures; to finance the latter by borrowing; in particular to search out productive federal, state and municipal expenditures such as: public buildings to replace rented quarters, reforestation, toll bridges, water works, and perhaps some means of financing large scale housing operations.

"Governmental budgeting should be based on the business cycle, Mr. Flanders believes, not on the fiscal year. The enormous retirement of government bonds up to 1930 should have developed a 'line of credit' for borrowing now. Bankers and the investing public must change their psychology. Balancing the governmental budget within the fiscal year, particularly for capital expenditures, is puerile.

"Long time budgeting policies by the government can compensate for unavoidable unbalancing operations of individuals and businesses," Mr. Flanders stated in concluding. "It is the responsibility of business men as citizens to see and understand, and not be moved by waves of mass psychology."

Facts and Figures

C. D. REICH, vice-president, Dexter Folder Co., in his address, stated that: "The chief executive may well start with an impartial appraisal of his own attitude. Is he aware of the rapidity with which changes are taking place in the industry? Does he keep in touch with economic trends at home and abroad? Is he continually seeking new ideas and applying them to his product, methods and policies?"

The fullest possible use should be made of fact-finding facilities, both within and without an organization, Mr. Reich said. Up-to-the-minute cost figures; the findings of the research departments; forecasts of activities at regular intervals; systematic study of trade papers, technical magazines, of new books on technical and business subjects, and of economic services were methods that he mentioned by which an organization may keep in touch with changing conditions.

The setting up of a series of accounting standards was advocated by COLONEL MALCOLM C. RORTY to prevent the issuance of erroneous or deliberately misleading corporate statements.

"Specific abuses in corporation reports," Colonel Rorty said, "almost invariably have their ultimate effect in showing incorrect figures for net earnings. Usually the attempt is to show earnings higher than they actually are, although occasionally a desire to manipulate the value of securities, or even an excess of conservatism, may lead to a concealment of earnings."

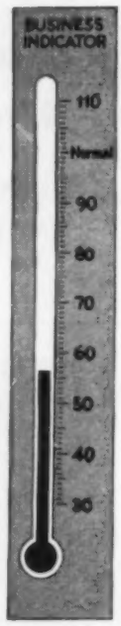
A standing joint committee of the leading professional accounting societies was suggested as the agency that most appropriately might establish the required accounting standards. Also, the various statistical and financial services should be specially interested in securing the adoption of such standards.

To cause a wholesale improvement in corporation reports Colonel Rorty suggested that the organized stock exchanges might bring their compulsive

THE BUSINESS WEEK

May 11, 1932

As we move into May the slight spring spurt of early April seems to be petering out . . . Steel mill activity is still slowly increasing under the certain stimulus of low-price automobile production, but the price structure is weakening under competitive consumer pressure and prospects of further wage cuts . . . Electric power production and merchandise carloadings show slackening response to seasonal influences . . . Building contracts made a better showing in April and have stopped declining, but are below a subsistence basis . . . Commodity price averages show some tendency to stabilization, but security markets have slid off to pre-war levels under legislative uncertainties and necessitous liquidation . . . Foreign hysteria over "inflation" has come to the surface and started gold exports again . . . In spite of all these discouraging developments the basic conditions for business recovery are being quite clearly established, although they are utterly and almost universally ignored . . . Administration measures and Federal Reserve efforts have unquestionably created an enormous improvement in the banking position in the past two months, but the campaign for credit expansion is at a standstill because Congressional chaos has wrecked business and banking confidence . . . Anxiety over the bonus, the budget, the tax bill, bank reform measures, stock-market muck-raking and the early adjournment of Congress are the only outstanding obstacles to business and financial stabilization . . . If these incubi could be quickly removed there might be a better chance for steady business recovery.



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Report Progress in Lubricant Research

During the past nine months the Lubricants Research Sub-committee, Society of Automotive Engineers, Inc., organized in June, 1931, to develop tests for the evaluation of the properties of "Extreme Pressure Lubricants," and to formulate tests for the determination of requirements of such lubrication for gears and bearings, has made a general survey to determine what information is available on this subject and to outline a program for carrying on the work.

It is estimated that the desired information on the most important phase of the work—load-carrying capacity—can be obtained in one year. This research is to be financed by individual contributions from the industries interested in this project.

Personnel of the subcommittee is made up of six subdivisions as follows: Automotive Group: H. C. MOUGEY, General Motors Corp., chairman; Axle & Transmission Group, F. E. MCMULLEN, Gleason Works, chairman; Bearings Group, ERNEST WOOLER, Timken Roller Bearing Co., chairman; Oils Group, R. E. WILKIN, Standard Oil Co. (Ind.), chairman; Operators Group, T. C. SMITH, American Telephone & Telegraph Co., chairman; Truck Group, A. J. SCAIFE, White Motor Co., chairman. COL. H. W. ALDEN, Timken Detroit Axle Co., is chairman of the entire committee, and DR. H. C. DICKINSON, Bureau of Standards, is secretary.

power to bear upon corporations by making it a condition of listing or trading in the securities of any corporation that such corporation, in connection with each annual or other published report, state over the signature of its chief accounting and executive officers, and of its independent auditors, whether or not the accounting standards of the joint committee as from time to time supplemented and revised, have been followed."

"The losses incident to the inability of management to encompass its larger problems have more than offset the economies resulting from the larger scale of operations," said DR. ARTHUR STONE DEWING, professor of finance, Harvard University. "In other words, as consolidated companies have grown larger, economies have been effected in production; but at the same time, wastes of effort and various forms of human limitations and inefficiencies have grown at a greater rate, so that what has been gained by consolidation in lower costs of production has been more than offset by losses in human effort.

"Probably the largest single reason for the formation of consolidations during the years 1919-1929," Professor Dewing stated, "was the hope of large prospective profits on the part of the bankers. Many of these consolidations were conceived and hatched out merely for the purpose of giving bankers increased volume of securities to sell to an avaricious and unthinking investing public."

WILLIAM J. GRAHAM, vice-president, Equitable Life Assurance Society, was reelected president of the Association, and SAM A. LEWISOHN was chosen to succeed himself as chairman.

New divisional vice-presidents elected were: C. E. ALLEN, Westinghouse Electric & Mfg. Co., consumer marketing division; EARLE WHITEHORNE, McGraw-Hill Publishing Co., public relations; C. S. CRAIGMILE, Belden Mfg. Co., mass production; H. B. BERGEN, Procter & Gamble Co., personnel; and FRANK L. ROWLAND, Lincoln National Life Insurance Co., office management.

• BUSINESS ITEMS •

Hope Windows, Inc., has been formed at Jamestown, N. Y., with a capitalization of $1,000,000 by two of the largest independent manufacturers of metal windows, casements, screens and allied products. The new concern came about through the acquisition of the capital stock of Henry Home & Sons, Inc., New York, by International Casement Co., Inc., Jamestown. MAJOR FRANK G. GARRATT is president and general manager; VICTOR RICHARDSON, vice-president, and JOHN BLEARS, secretary and treasurer of the new concern.

Negotiations are being completed for the merging of Russ Mfg. Co., Cleveland, Ohio, with Bastian-Blessing Co., Chicago. The Russ Co. manufactures soda fountain equipment.

Northern Conveyor & Mfg. Co., Janesville, Wis., has been placed in receivership by the state circuit court on petition of E. E. CLEMONS of Janesville, a stockholder. For several months the plant has been managed by a committee with the consent of the officers. Following the appointment of GEORGE DEBRUIN, secretary of Rock County Savings & Trust Co., Janesville, as receiver, EDGAR J. LEACH of Janesville has been appointed to take charge and manage the property.

Property of Machinery Forging Co., 5450 Hamilton Ave., N.E., Cleveland, including the works and equipment, will be offered at public sale on Mar. 27 by the receiver, NORBERT K. HIRSCHMAN. The plant made forgings for various machine plants.

Metalcraft Corp., St. Louis, Mo., manufacturer of metal toys, has installed $35,000 worth of new machinery and equipment. S. C. MCCLUNEY is president.

Associated Manufacturers' Engine Co. plant, Waterloo, Iowa, has been taken over by L. F. BUTTS who will open a contract machine and welding shop. H. A. LENIUS, in charge of the plant for the Manufacturers' company, will continue to handle business for that company.

Property of W. E. Lamneck Co., 416 Dublin Ave., Columbus, Ohio, including land and buildings, merchandise, machinery, dies, patents, furniture and fixtures will be sold at public auction

May 19, 20 and 21, through Industrial Plants Corp., Columbus. The Lamneck company is one of the largest manufacturers in the United States of furnace pipe, stove pipe, registers, laundry dryers, agricultural products, and other items.

National Lighting & Protection Co., St. Louis, has been organized through consolidation of several lightning rod companies with S. D. KRETZER as president. The concern has acquired a plant and spent $30,000 in construction of a machine shop and foundry and for installation of machinery and equipment.

General Motors Corp. has announced the purchase of Packard Cable Co., Warren, Ohio, which is to be affiliated with Delco Remy Corp., headquarters at Anderson, Ind. FREDERICK KROEGER will be general manager. The Packard plant will remain at Warren for the present but later probably will be moved to Anderson or Muncie, Ind.

An application for incorporation of Poole Foundry & Machine Co., Union Ave. & Clipper Mill Rd., Baltimore, Md., has been made by S. PROCTOR BRADY, president, Poole Engineering & Machine Co., Baltimore; S. PROCTOR BRADY, JR., and LAURENCE M. RICKETTS. Authorized capital stock is 4,000 shares of common, par value $25 each.

Kieley & Mueller, Inc., 34-38 West 13th St., New York City, has purchased a new plant at Newark, N. J., now ready for occupancy. For the present an office will be maintained at the New York address, while all manufacturing will be done in the new plant.

American Metalcraft, Inc., Indianapolis, Ind., has filed articles of incorporation. Directors are H. R. DEWOLF, A. J. GIBBONS and W. G. HIMMEL. Company will manufacture metal specialties.

Prosch Boiler Works, 1430 Ash St., Terre Haute, Ind., has been purchased by RUSSEL R. LENTZ, JEFFERSON LENTZ and EDWARD MEYER. Company will continue to make boilers, tanks, stack and structural steel.

Construction Machinery Co., Waterloo, Iowa, maker of road building machinery, hoists and pumps, is selling its entire assets at auction May 12.

Hofius Steel & Equipment Co., Seattle, Wash., has acquired the plant of Earl B. Staley Co., Seattle, manufacturer of automobile truck bodies and road oilers. Mr. Staley becomes vice-president of the Hofius company.

International-Stacy Corp. directors and officers have resigned preliminary to the election of a new board of trustees composed of ROGER WILLIAMS, B. S. WELLMAN, and S. H. BARRETT, Columbus, O.; A. A. CORCORAN, Cleveland; O. M. HAVEKOTE, Carnegie Steel Co., and LEWIS J. BROWN, who has been serving as acting general manager of the company since April 1. Reorganization is being effected to improve the company's cash position.

Danubian States Offer Rich Field For Exports of Machinery, Machine Tools

France Still Seeks Treaty — Likely to Get It — League of Nations Releases Figures on Tool Trade

PARIS—The five Danubian States, Czechoslovakia, Roumania, Austria, Hungary and Yugoslavia, once again put upon a buying basis, will offer a profitable trading territory, League of Nations experts believe. In spite of the London check in April a plan is still being sought under the spur of M. André Tardieu who sees above all an impetus to French trade therein if only commercial exchanges between the five states of the group and with the outside world can be revivified by the adoption of a sort of free trade zollverein with a variation of treatment for the "ins" and the "outs."

League experts, in an eloquent statistical table, have harked back to the wonder year of 1929 as an indication of what may still be done. Nothing since that time shows anything but progressively dwindling returns.

Mostly the group bought their outside goods from Germany. The year's purchases of machinery and machine tools and "other tools" totaled 104,210,000 marks. Breaking down the table and reducing the specific figures to dollars, shows German exports to the respective countries as follows:

	Czechoslovakia	Austria	Roumania	Yugoslavia	Hungary
Tools	1,367,000	955,200	688,800	931,200	427,200
Machinery (including machine tools)	8,728,800	4,636,800	2,011,600	3,139,200	2,088,000
Great Britain's exports were:					
Machines	1,422,165	557,790	1,115,905	440,285	910,905
In the same year Great Britain imported from Austria electric equipment for £301,884, and from Czechoslovakia £53,546.					
French exports were:					
Machines and tools	560,000	404,000	604,000	344,000	120,000

France at the same time imported machinery and tools from Czechoslovakia to the value of 20 million francs. Incidentally France sold airplanes to Roumania to the value of 17,100,000 francs and to Yugoslavia, 40,300,000 francs.

Italy supplied chiefly automobiles to the Danubian countries. Other fabricated metal imports from Italy were less than one per cent of the total of such imports. As a contra-parti Czechoslovakia sold "machines and instruments" to Italy for a value of 13,500,000 lire.

Switzerland's exports to the banks of the Danube were in the competing year:

Czechoslovakia	Austria	Roumania
1,214,000	1,000,000	1,192,000
Yugoslavia	**Hungary**	
202,200	305,200	

Germany's total exports to these Danubian countries of 58 million population approximate 10 per cent of the country's entire exports and equal 21 per cent of the entire Danubian imports. The percentages relating to other countries are far down the scale. French exports to the Danube reached but a fifth of the value of those to Switzerland which has a population of but 4 million.

United States participation, according to these latest compiled figures of the League of Nations economic section and intended to serve as a guidance to the reopening of negotiation before, during or after the Lausanne reparations and debts conference in June, is not of a considerable importance compared to that of Germany but stands ahead of the other chief exporting countries when machinery and tools are concerned.

Percentage of Total Machinery Imports

	U. S. A.	G. Britain	Germany	France	Italy	Switzerland
Austria	2.4	2.9	72.	1.8	.2	7.0
Hungary	13.3	3.9	46.7	2	.7	3.1
Roumania	9.3	6.5	41.	4.8	1.2	2.8
Czechoslovakia	5.2	10.4	74.6	3.	...	3.7
Yugoslavia	4.1	8.8	36.2	3.2	1.2	.9

Other machine imports represent transactions within the grouped states, as for instance Austria's imports of machinery from Czechoslovakia of 6.4 per cent of the total of like imports, while if manufactured goods of metal are included, another 28 per cent is added.

For many reasons, it is not suggested that American makers of machinery and tools can reach out and get the big bulk that has gone to the German maker, but there is danger that practically no trade at all will be left for the outsider if the close-coupled sort of zollverein plan goes through. Such a plan will bring free trading within the group and with those states beyond the frontiers which will grant like privileges. Thus will fall to the ground the "most favored nation" clause which was supposed to protect trade abroad for all who adopted or granted it.

The further statement is made by League experts that all statistics, particularly those of the last two years, show what are to be considered as disappointing results, in that while commodity prices have shrunk on an average of 30 per cent so far as the incoming and outgoing trade of the Danubian states is concerned, quantity imports and exports have shown even a greater shrinkage. Germany has increased her export percentages to the Danubian states from 1928 up to and including 1931. Those of France have fallen off, a slight increase being to the credit of Great

Britain as also of Italy, while Switzerland has remained stationary. From all other countries the percentage has fallen from 39.4 to 35.

Germany, being allegedly poor, has reduced her purchases from 30.7 per cent to 24.3 per cent, but France, professedly rich though paradoxically crying poor, has increased hers from 3.3 per cent to 7.7 per cent. Great Britain has run the scale up from 8.7 per cent to 11.8 per cent. Italy has remained stationary and Switzerland shows a slight increase. Other countries have increased their purchases from 35 per cent to 36.1 per cent.

New G.E. Department

An air conditioning department has been organized within the General Electric Co. for the manufacture and market of electrical devices for home heating, humidifying and temperature control. J. J. DONOVAN, Cleveland, will be manager of the department. Associated with him will be E. D. HARRINGTON, also of Schenectady, in charge of application engineering; J. R. RUE, Pittsfield, Mass., in charge of manufacturing, and H. S. WOODRUFF, Schenectady, in charge of design engineering. Headquarters will be maintained at General Electric's New York offices, 120 Broadway.

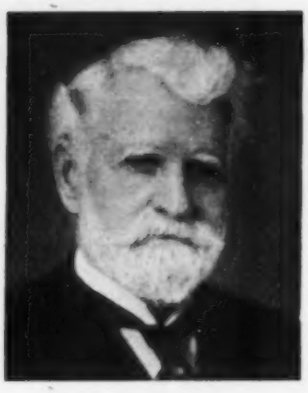
• PERSONALS •

J. D. ADELMAN, Des Moines, Iowa, who was instrumental in organization of the syndicate which last December acquired the One-Minute Mfg. Co., Newton, Iowa, and changed its name to the One-Minute Washer Co., has been elected president of the concern. CLYDE B. CHARLTON, also of Des Moines, was elected vice-president and R. C. HAMMER, Newton, secretary-treasurer. Mr. Adelman is general manager of the plant. In addition to these officers the directors include: F. H. BERGMAN, Newton, chairman of the board. Sales officers are maintained in Des Moines.

EDWARD D. BRATTON retired May 1 as manager and superintendent of the Buffalo Lamp Works, General Electric Co. He had been associated with this company and its predecessor, the Mahoning Lamp Works, for 39 years.

THEODORE M. EDISON, youngest son of the late THOMAS A. EDISON, has been granted exclusive rights by the United States Patent Office on a device for the elimination of vibration of machinery. The device is said to be attachable to any machine from a phonograph to a large dynamo with the result that all vibration will cease.

W. G. ELLIS, Philadelphia representative of Ohio Electric Mfg. Co., maker of lifting and separation magnets and of fractional size motors, has moved his office to 1473 Broad St. Station Bldg., Philadelphia.



AMBROSE SWASEY

To be presented with the Franklyn Medal of the Franklyn Institute, May 18

JOHN P. FERRIS, chief engineer, Oilgear Co., Milwaukee, has been elected assistant secretary of the governor's executive council and secretary of the council's committee on business economics at Madison, Wis., and has been granted indefinite leave of absence to assume his new duties.

ARTHUR E. FOCKE, Diamond Chain & Mfg. Co., has been elected chairman of the Indianapolis Chapter, A.S.S.T. Other officers elected are ELAM E. WILLIAMS, vice-chairman; ROBERT L. FITZSIMMONS, secretary; and AXEL WYDELL, treasurer.

R. C. GLANDORF, advertising manager of Aluminum Industries, Inc., has been transferred to the outside sales organization, according to an announcement by W. E. MCILROY.

R. E. W. HARRISON has resigned as sales engineering director of Cincinnati Milling Machine and Cincinnati Grinders, Inc.

G. A. HOLMES has been named general manager of Sparton of Canada, Ltd., at London, Ont.

J. C. HUNSAKER has been appointed to serve the Society of Automotive Engineers for a term of four years beginning May 4 as its representative on the Daniel Guggenheim Medal Board of Awards.

O. E. LAECHELT, for the past five years with Bunting Brass & Bronze Co., Toledo, has joined the sales department of the Detroit Seamless Steel Tubes Co.

Presentation of the Kelvin Medal, one of the most highly prized honors in the engineering profession, was made recently to GUGLIELMO MARCONI.

J. S. TRITLE, vice-president and general manager of Westinghouse Electric & Mfg. Co., has been elected vice-president in charge of operations of Westinghouse Electric Supply Co., wholesale distributor of Westinghouse products to electrical dealers, contractors and industrial establishments.

GEORGE H. WEILER, until recently secretary-manager, Forging Manufacturers Association, has joined the sales department of the Standard Steel Works Co., with headquarters at Burnham, Pa.

• OBITUARIES •

EDWARD H. CROSBY, 64, vice-president, Veeder-Root Inc., Hartford, Conn., died Apr. 30 at that city. He joined the Veeder Mfg. Co. at the time of its organization in 1895.

CARL L. DORER, SR., 80, president, Dorer Foundry Co., Bellaire, O., died there May 2.

ALLAN V. GARRATT, 74, nationally known hydraulic engineer, died recently at his home in Holliston, Mass. Mr. Garratt was the first secretary of N.E.L.A., chairman of its first committee to draw up an electrical safety code and of the first committee on wire gage standards. He was also a member of A.I.E.E. He was the recipient of a gold medal for notable work in methods of water-wheel governing at the St. Louis Fair and during the war perfected a firing mechanism for anti-aircraft guns. At the time of his death he was a consultant in hydraulics and eastern representative of Redwood Manufacturers, Ltd., with an office in Boston.

CHARLES JEFFERSON HARRAH, 76, former president, Midvale Steel Co., Nicetown, Pa., died in France May 2.

ANTHONY HENNINGER, 64, a director and employment manager of the Warner Corp., gear manufacturer, Muncie, Ind., died recently.

HUGH KENNEDY, 39, vice-president, Robert Mitchell Metal Mfg. Co., Montreal, died May 4 in New York City.

F. F. LANDIS, one of the founders of the Landis Tool Co., Waynesboro, Pa., died May 2. With his brother, A. B. LANDIS, he started in 1889 the firm of Landis Brothers, later incorporated as the Landis Tool Co. During recent years neither of the brothers has been active in the company.

LEO R. LANGE, 42, a consulting mechanical engineer in Portland, Ore. died recently. He was a past president of the Oregon Section, American Association of Engineers, and a director in the Professional Engineers of Oregon Association.

FRANKLIN G. NEAL, St. Louis, general superintendent, St. Charles, Mo., branch, American Car & Foundry Co., New York, died recently after a long illness.

DONALD M. RYERSON, 47, chairman of the board of Joseph T. Ryerson & Son, died suddenly, May 8, near his home in Lake Forest, Ill. He had suffered a nervous breakdown.

CAMERON C. SMITH, 71, founder of the Union Steel & Pittsburgh Rolls Corp., and president of that concern for several years, died suddenly in Jacksonville, Fla., following a heart attack.

The Job Ahead Silver Bay Topic

"New Levels of Management Effectiveness—The Job Ahead," will be the general theme of a conference of the nation's smaller industries to be held at Silver Bay, N. Y., July 11-16, under the auspices of the Silver Bay Industrial Institute. The conference will take stock of the effects of the present economic situation on smaller industrial companies and will attempt to evaluate them.

Among those active in arranging details of the conference are: W. A. DOWER, Manufacturers Association of Connecticut, Hartford, Conn.; W. E. ODOM, National Metal Trades Association, Chicago, Ill.; FRANK E. REDMOND, Associated Industries of New York State; RALPH E. FLANDERS, American Society of Mechanical Engineers; HOWARD S. SMITH, Trumbull Electric Mfg. Co., Plainville, Conn.; J. H. VERTREES, Rutgers University Extension Division, New Brunswick, N. J.; A. S. REGULA, New York City; ALLAN H. MOGENSEN, *Factory and Industrial Management*, New York City; WILLIAM H. LANGE, Metropolitan Life Insurance Co.; R. J. ANDERSEN, Dairymen's League Cooperative Assn., Inc., New York City; W. E. BOOTH, Foxboro, Mass.; HOWARD B. FONDA, J. O. KELLER, Penn State College; J. A. MORFORD, American Standards Association, New York City; LESTER W. AIGELTINGER, Wrightsville, Pa.; F. J. MCMAHON, Norwalk, Conn.; GEORGE J. SCHURTZ, Bayonne, N. J.

Exhibit New Products

Seventy-six leading New England industries exhibited new products to the Boston market recently under auspices of the New England Council at the exhibition conducted in connection with the Council's New Products Conference. New products are being turned to increasingly by progressive industries as a means of getting business under depression conditions. The New England Council's Industrial Committee, which sponsored the conference and exhibit, has been assisting New England industries in the development of new products for some months, and held the conference and exhibit as a means of stimulating interest in the marketing and merchandising of these products.

Case Hardening A.S.S.T. Subject

H. W. MCQUAID, metallurgist, Timken-Detroit Axle Co., Detroit, spoke on "Case Hardening and All That Goes With It" at a meeting of the New York Chapter, A. S. S. T., May 9. Nominations for officers of the chapter were announced as follows: Chairman, E. M. WISE, International Nickel Co.; Vice-Chairman, A. B. KINZEL, Union Carbide & Carbon Co.; Secretary-Treasurer, T. N. HOLDEN, E. W. Bliss Co.; Executive Committee, C. E. MEISSNER, U. S. Steel Corp.; R. M. KIRK, General Alloys Co.; AL GOBUS, Brooklyn, N. Y.; F. T. SISCO, Engineering Foundation; J. S. VANICK, The International Nickel Co.; C. D. BARNHART, W. S. Rockwell Co.; M. T. GARLINGER, American Tel. & Tel. Co.; H. C. BOSTWICK, Westinghouse Electric & Mfg. Co.; J. R. DAWSON, Union Carbide & Carbon Co.; H. M. GERMAN, Crucible Steel Co. of America; SAM TOUR, Lucius Pitkin, Inc. Only one nomination was made for each office.

S.A.E. Plans for Summer Session

Among the sessions so far planned for the Summer Meeting of the Society of Automotive Engineers at the Green Briar Hotel, White Sulphur Springs, W. Va., June 12-17, one is to be devoted to power brakes for trucks and trailers. Other sections will deal with engine and frame design, free-wheeling devices and control, brake drums and brake linings, future design and appearance of automobiles, large stampings and dies used in body work, streamlining and Diesel engines.

Arrangements for the meeting are being handled by B. B. BACHMAN, L. R. BUCKENDALE, A. F. COLEMAN, C. L. LAWRENCE, A. S. MCARTHUR, A. J. NEERKEN, A. J. POOLE, D. G. ROOS, S. W. SPARROW, W. B. STOUT, and numerous others. N. G. SHIDLE, meetings committee chairman, is coordinating the over-all design of the meeting.

Economics Subject Of Summer Sessions

A summer school for engineering teachers giving particular attention to the subject of economics will be conducted at Stevens Institute of Technology, Hoboken, N. J., July 5-21, by the Society for the Promotion of Engineering Education. The school has the active cooperation and support of Stevens Institute and the Carnegie Corp. of New York. It is under the immediate direction of the director of summer schools, HARRY P. HAMMOND, 99 Livingston St., Brooklyn, N. Y. The staff of the session on economics comprises some 30 or more leading economists and teachers of engineering under the local director, HARVEY N. DAVIS, president, Stevens Institute of Technology. JAMES CREESE, vice-president, Stevens Institute of Technology, is secretary and WILLIAM D. ENNIS, professor of economics of engineering at Stevens, is chairman of the teaching staff.

Metal Congress Paper Topics

A wide range of both practical and research papers will be presented at the Fourteenth Annual National Metal Congress & Exposition, Buffalo, the week of Oct. 3, in which seven societies and divisions are cooperating. The American Society for Steel Treating has announced that its program this year will be divided into sessions dealing with the following topics: reports of metallurgical research; nitriding; drop forging; corrosion-resistant steels; sheet steel; high-speed steels; deep acid etching of steels; and heat treatment.

Technical programs for the National Metal Congress are also being arranged by the American Welding Society; Iron and Steel and Institute of Metals Divisions of the American Institute of Mining & Metallurgical Engineers; Iron and Steel Division of the American Society of Mechanical Engineers; Production Activity Division of the Society of Automotive Engineers; and the Wire Association. Advance space reservations for the Exposition have exceeded expectations, W. H. EISENMAN, director of the Exposition, has announced.

• MEETINGS •

CHAMBER OF COMMERCE OF UNITED STATES
Annual meeting, Palace Hotel, San Francisco, May 17-20. D. A. Skinner, 1615 H St. N.W., Washington, D. C., secretary.

AMERICAN IRON AND STEEL INSTITUTE
Forty-first general meeting, Hotel Commodore, New York City, May 19. Howard H. Cook, secretary, 350 Fifth Ave., New York, N. Y.

AMERICAN SOCIETY OF MECHANICAL ENG'RS
National Aeronautic and Process Meetings, Hotel Statler, Buffalo, N. Y., June 6-7-8.
Second National Applied Mechanics Meeting, Yale University, New Haven, Conn., June 23-24-25.
Semi-Annual Meeting, Bigwin, Canada, June 27-30.
National Machine Shop Practice Meeting, Buffalo. Week of Oct. 3. Calvin W. Rice, secretary, 29 W. 39th St., New York, N. Y.

SOCIETY OF AUTOMOTIVE ENGINEERS
1932 summer meeting, Greenbrier Hotel, White Sulphur Springs, W. Va., June 12-17. John A. C. Warner, secretary, 29 W. 39th St., New York, N. Y.

AMERICAN SOCIETY FOR TESTING MATERIALS
Annual meeting, Atlantic City, June, 20-24. R. E. Hess, assistant secretary, 1315 Spruce St., Philadelphia, Pa.

NATIONAL METAL CONGRESS & EXPOSITION
174th Regiment Armory, Buffalo, N. Y., Oct. 3-7. Sponsored by A.S.S.T., with cooperation of A.S.M.E., Institute of Metals and Iron & Steel Divisions of A.I.M.E., A.W.S., and the Wire Association. W. H. Eiseman, 7016 Euclid Ave., Cleveland, Director.

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Opportunities for Future Business

Ariz., Kingman—Arizona Mining & Milling Co., plans construction of a 500 ton mill and other improvements to owner's property. Estimated cost $600,000.

Calif., Sunnyvale—Bureau of Yards & Docks, Navy Department, received lowest bid for construction of five industrial buildings at Naval Air Station from Robert E. McKee, 108 West Sixth St., Los Angeles, Calif. $165,000. Noted March 31.

D. C., Washington—Department of Interior, will receive bids until May 31 for a group of buildings including moving, relocating and remodeling shop buildings, also construction of a male receiving building, etc.

Ia., Oelwein—Chicago Great Western Railroad, Grand Central Station, Chicago, Ill., plans extensions and improvements to engine house here. Estimated cost $100,000. C. G. Delo, Grand Central Station, Chicago, ch. engr.

Ia., Sioux City—Bekins Van & Storage Co., Paul Bekins, Pres., Fifth St. and Wesley Way, awarded contract for a 1 story, 22 x 150 ft. service garage.

Ia., Waterloo—W. Cowan, 612 Commercial Bldg., awarded contract for construction of a 1 story, 30 x 40 ft. repair and service garage at 5th Ave. and Commercial St.

Mass., Chicopee — Shell Eastern Petroleum Products Inc., 141 Milk St., Boston, plans construction of a service station at Centre and School Sts. here. Estimated cost $25,000. Private plans.

Mass., Roxbury (Boston P. O.)—Tidewater Oil Co., 17 Battery Place, New York, N. Y., awarded contract for a 1 story service station at 1744 Centre St. here. Estimated cost $40,000.

Mass., Springfield—Sanford Tire Corp., J. S. Coughlin, 34 Sanford St., awarded contract for construction of a 1 story, 30 x 116 and 30 x 73 ft. automobile service station at Gardner and Main Sts. Estimated cost $40,000. Goodyear Tire & Rubber Co., 1144 East Market St., Akron, O., lessee.

Mass., Worcester—Sewer Department, c/o J. H. Brooks, Jr., awarded contract for construction of a 3 story, 55 x 175 ft. shop on East Worcester St. Estimated cost $40,000. Noted April 14.

Minn., Central Lakes (P. O. Cotton)—International Peat Products Co., L. M. Sparling, Supt., plans improvements to plant. Estimated cost $20,000.

N. J., Bayonne—Hartol Products Co., 117 Liberty St., New York, N. Y., lessee, will receive bids after August 1 for oil tanks and bulk storage building at Bergen Point here. Estimated cost to exceed $40,000.

N. J., Hoboken—Hinde & Dauch, 253 Water St., Sandusky, O., awarded contract for construction of a 1 story, 160 x 700 ft. paper manufacturing plant at Monroe and Madison Sts. between Ninth and Eleventh Sts. here. Estimated cost $400,000. Noted April 28.

N. J., Newark—Flake-Ice Corp., 205 Water St., Brooklyn, N. Y., leased premises at 574 Ferry St. here and plans alterations and equipping of machine shop and laboratory building. $40,000. Owner now purchasing equipment.

N. J., Perth Amboy—Raritan Copper Works, plans reconstruction of plant and boiler house destroyed by explosion at Elm and Market Sts. Estimated cost to exceed $40,000.

N. J., Pine Brook—Pine Brook Lumber Co., plans reconstruction of lumber mill and storage building on Bloomfield Ave. Estimated cost to exceed $40,000.

N. J., Plainfield—Owner, c/o C. C. Bell, 8 South Ave. W., Cranfield, Archt., plans construction of a 1 story garage here. Estimated cost $40,000.

N. J., Somerville—Board of Education, Court House, plans construction of a 2 story vocational school. Estimated cost $150,000. Architect not selected. Maturity indefinite.

N. Y., Bedford Hills—Department of Correction, State Office Bldg., Albany, will receive bids until May 17 for construction of a group of buildings including storehouse and industrial building, etc., at Westfield State Farm, here.

N. Y., Brooklyn—National Meter Co., 299 Broadway, New York, awarded contract for alterations to plant at North 9th St. and East Kent Ave. here.

N. Y., Long Island City—G. U. Harvey, Pres. Queens Borough, Queens Subway Bldg., plans completed for construction of shop and storage sheds at 45th and Vernon Aves. L. Lorell, c/o owner, Archt.

N. Y., Long Island City—Harold H. Anthony Inc., 3159 12th St., having plans prepared for a 30 x 30 ft. garage, 17 x 30 ft. repair and service station, each 1 story at Vernon Blvd. and 31st Drive. V. Schiller, 30-64 41st St., Astoria, Archt.

N. Y., Long Island City—Springfield Petroleum Corp., 1772 Southern Blvd., New York, having plans prepared for construction of a 1 story, 21 x 97 ft. service station and repair shop at Merrick Road and Farmers Blvd. here. Private plans.

N. Y., Long Island City—Angelina Fresca, 84-44 85th Ave., Woodhaven, plans completed for a 2 story, 34 x 72 ft. service garage, etc., at Paulina Road and Margaret Place. J. Rofrano, c/o owner, Archt.

N. Y., Long Island City—William Prym of America, 34-12 36th Ave., leased additional space at 4728-38 37th St. and plans to equip for the manufacture of pins, snap fasteners, etc. Estimated cost to exceed $40,000. Maturity later.

N. Y., Millwood—Westchester County Park Commission, Bronxville, plans construction of a service building here. Estimated cost $40,000.

N. Y., New York—James Hopkins, 199 Franklin St., plans construction of a 27 x 42 ft. repair shop and brake testing building at 198 Finn Sq. E. Guterman, 164 Montague St., Brooklyn, Archt.

N. Y., New York—Julemore Co., M. Galt, Pres., 277 Broadway, plans alterations to service garage, 1 story, 100 x 200 ft. at Ninth Ave. and 204th St. N. Langer, 81 East 125th St., Archt. and Engr.

N. Y., New York—Joseph Lavazoli, 308 West 68th St., plans alterations to service garage, 2 and 3 story, 43 x 100 ft. at 263 West 69th St. Estimated cost $40,000. J. E. Geissberger, 103 Park Ave., Archt.

N. Y., New York—Harry W. Thedford, 270 Riverside Drive, plans a 2 story, 25 x 100 ft. service garage at 307 West 44th St. Charles Schaefer, Jr., 332 East 149th St., Archt.

N. D., Grand Forks—James Turner & Sons, J. F. Turner, mgr., plans to rebuild sash and door plant destroyed by fire. Loss $35,000.

O., Cincinnati—Cincinnati Union Terminal Co., H. M. Waite, Ch. Engr., 1020 Temple Bar Bldg., will soon award contract for construction of a 3 story, 42 x 492 ft. yard service building. Estimated cost $270,000.

O., Cleveland—Cleveland Heater Co., Locust Ave., plans two 1 and 2 story, 100 x 140 and 100 x 200 ft. additions to plant. Estimated cost to exceed $60,000. George S. Rider & Sons, Marshall Bldg., Archts.

O., Piqua—Piqua Handle & Manufacturing Co., manufacturers of woodworking equipment and novelties, plans to rebuild plant destroyed by fire. Estimated cost $40,000. Maturity indefinite.

R. I., Cranston—Service Battery Shop, 263 Broadway, Providence, will build a 1 story service station and show room on Station St. here. Estimated cost $40,000. F. Chiaverini, 32 Broadway, Providence, Archt. Owner will build by separate contracts. Noted March 31.

R. I., Newport—H. L. Rooney, 116 Bellevue Ave., will not build 1 story, 78 x 112 ft. automobile service station at Casino Terrace. $40,000. E. M. Corbett, 49 Purchase St., Fall River, Archt. Postponed indefinitely. Noted April 7.

S. D., Sioux Falls—Wilson Oil Co., W. Wilson, Pres., awarded contract for construction of a 1 story, 30 x 110 ft. service station including repair and service shop. Estimated cost $25,000.

Tex., Pampa—Texas Elf Carbon Co., awarded contract for building and equipping unit of plant including 60 x 80 ft. warehouse, 60 x 312 ft. storage building, 60 x 80 ft. cooling house, etc. $65,000.

Utah, Park Valley—Utah Gold Milling & Mining Co., Salt Lake City, plans construction of a 150 ton ore mill here. Estimated cost $40,000. F. W. McIntyre, Salt Lake City, is engineer.

Wis., Appleton—Tschank & Christensen, 417 West College Ave., awarded contract for construction of a 2 story, 25 x 120 ft. metal working plant. Noted April 21.

Wis., West Allis—Allis Chalmers Manufacturing Co., West Allis, and 50 Church St., New York, N. Y., awarded contract for a 1 story, 50 x 70 ft. addition to shop building here. Estimated cost including equipment $40,000.

Wyo., Buffalo—State Highway Commission, will soon award contract for construction of a 42 x 84 ft. shop and storage building and 12 x 20 ft. boiler house. T. Moore, Sheridan, is engineer.

Wyo., Casper — Tristate Rapid Transit Inc., c/o I. J. Clark, local representative, plans construction of a 3 story, 100 x 100 ft. warehouse and car storage building. Will also be used as bus station.

Ont., Niagara Falls—Canadian Carborundum Co. Ltd., awarded contract for two additions to plant, 92 x 112 and 48 x 140 ft. 1 and 2 story. Estimated cost $100,000. Noted April 28.

Que., Port Alfred — Consolidated Power & Paper Corp., plans to rebuild part or all of fire damaged property including yards, timber storage for pulp manufacturing, transportation facilities, etc. Loss exceeds $3,000,000. Maturity indefinite.

Union Socialist Soviet Republics—c/o Amtorg Trading Corp., will build a machinery manufacturing plant at Kazan (Tatar Republic). Estimated cost approximately $155,000,000. Work will be done by day labor and technical aid contracts.

Equipment Wanted

Calif., Mare Island (sta. Vallejo)—Bureau of Yards & Docks, Navy Department, Washington, D. C.—will receive bids until May 17 for motor driven ball bearing band saw, also until May 24 for motor driven saw grinding machine for Navy Yards here. Sch. 7988 and 7971.

D. C., Washington—Bureau of Yards & Docks, Navy Department—will receive bids until May 17 (extended date) for motor driven turret lathe for Navy Yard. Sch. 7887.

D. C., Washington—Chief of Engineers, Munitions Bldg.—will receive bids utnil May 20 for woodboring machines, circular saws, timber saw, pneumatic drills, etc.

Mass., Dorchester (sta. Boston)—Owner, 721 Dudley St.—lathe, 4 ft. to 6 ft. bed, screw cutting.

O., Bexley — Board of Education, L. M. Krumm, Clk.—will receive bids until May 16 for small lathe, etc., for new senior high school.

O., Dayton—Contracting Officer, Material Division Air Corps, Wright Field—will receive bids until May 17 for 13 motor driven drill presses, Cir. 383; also until May 18 for one milling machine and two metal cutting cold saws. Cir. 380 and 379.